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BY F. O. BROILL.

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BY D. W. DAY.

INDUSTRIAL USES OF FUEL OIL.
BY F. B. DUNN.

INSIDE WIRING METHODS.
BY JOHN CARRELL.



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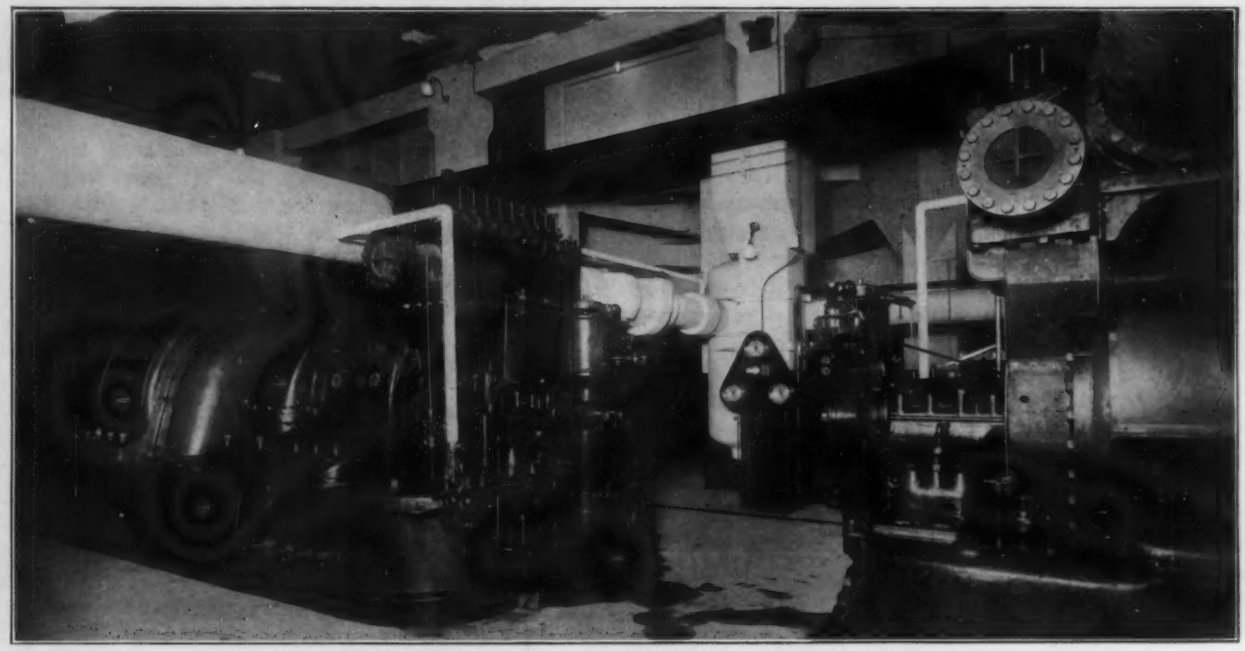
# NORTHWESTERN ELECTRIC'S HEATING SYSTEM

BY F. O. BROILI.

*(A discussion is here presented of the advantages of a central heating plant and the experience of the Northwestern Electric Company with such a system at Portland. The author is industrial engineer with the company.—The Editor.)*

When the Northwestern Electric Company of Portland, Oregon, decided to install a steam reserve plant to back up their water power generating station on the White Salmon River, they took into consideration the possibilities of installing a central heating plant in order to increase revenues. The idea was furthered when it was found that to serve the public properly, either a storage battery or a steam plant would have to be installed as an auxiliary.



Steam Turbines, Pittock Station, Northwestern Electric Company.

Owing to the many advantages of a central heating plant in connection with its use for reserve power purposes, the central heating plant was finally decided on, and installed in the basement of the large office building known as the Pittock Block.

Two 3500 kw. turbines were placed in the plant to operate non-condensing. They are operated as voltage regulators on the electric end by varying the field excitation, acting the same as any synchronous condenser. If a peak load should occur beyond the capacity of the water plant to handle, the turbines would take care of it.

The turbines are ordinarily floated on the system. The turbines can be made to carry enough load to furnish the steam required for the heating system, or the steam can be by-passed through reducing valves, or a combination of both can be used. The turbines being always on the lines, take up the load if there should be any interruption of the service from the water power plant. No delays can take place, such as often happens in the time of trouble on many power systems, where the steam plant must be brought into operation after something has happened. The

turbines in this plant are ready to put out their full capacity at all times, for an indefinite period, which is not the case with a storage battery.

In ordinary operations one or two turbines are operated, and all the steam required for the heating system goes through the turbines, carrying a part of the load. An automatic governor has been developed at the plant to keep the pressure on the low pressure side to within ½ lb. of whatever is required. The steam is sent through the turbines rather than through the reducing valves for various operating reasons.

Auxiliaries in Pittock Station.

The plant has been operating successfully since starting. The boiler pressure is 185 lb. with 125 degrees superheat. The superheat is greatly reduced when going through the turbines, but when any steam goes through the reducing valves there is trouble on the heating mains, due to the excessive superheat. A cold spray of water in the heating main beyond the reducing valve will absorb the superheat, but experiments are still in progress to perfect a system that will be more desirable.

On account of the low pressure of about five pounds on the heating mains, and the necessity of delivering steam at the distant ends of the lines without undue loss of pressure, large size pipes have to be used. Two 20 in. lines leave the station, and the sizes are gradually reduced. The lines are tied in with cross lines wherever possible. Condensation in the mains is a constant loss, being practically constant regardless of the load or time of the year. In the Northwestern Electric Company's system it averages about .025 lb. per hour per square foot of pipe surface. Radiation of heat from the underground pipes is reduced to the lowest possible amount by use of the American District Steam Company's system of distribution. This consists of a very efficient insulation made to surround the iron steam pipe. First the pipe is covered with a layer of asbestos paper, which is carefully wrapped around it, then an air space of about one inch is provided by centering the pipe within a heavy wooden stave pipe casing. This casing is lightly banded with steel wire, and painted with heavy tar paint. The interior is lined with bright tin to reflect radiated heat from the iron pipe, and between the tin and the wood is a sheet of asbestos to prevent charring of the casing.

Expansion and contraction is taken care of by special joints known as variators placed about every 50 ft. along the street trenches. At the anchored points right angle house service connections are taken off where needed.

The steam is sold entirely by meter. Flat rates have proved a failure where they have been tried by companies in other places. The most practical method of determining the amount is by measuring the condensation. Meters made for this purpose weigh the water, and are quite accurate, being easily adjusted to within 2 per cent.

The central station offers certain things that are of great value, and in the case of new buildings makes it unnecessary for the owner to invest in the equipment required for private generation of steam heat. The service is always at the command of the consumer. Neither fuel nor some one to handle it need be kept on hand. Simply opening a valve will give heat. This is extremely convenient, especially during the milder weather. Uniform temperature can easily be maintained. Overheating as well as underheating are unhealthy and unpleasant. Authorities agree that the best temperatures are around 65 to 70 degrees Fah., 68 degrees being probably the best for ordinary conditions. These temperatures can easily be maintained at all times with central station service.

Hot water service is always a problem of consequence until central station steam is used. In most buildings the condensation reaches the meter at a high temperature. If discharged into the sewer there will be a loss of 10 to 15 per cent of the available heat of the original steam. There are simple methods of conserving this heat and using it to supply hot water in whole or in part, depending on the season of the year and the quantity of water required.

Fig. 1 shows one method where the condensation goes through coils in the cooler which also acts as a heater for the fresh water supply. The storage tank supply circulates as long as the temperature of the water from the cooling coils is higher than the water in the storage tank. In the winter time few buildings require steam to heat the hot water but as the weather gets milder steam must be used through an instantaneous heater, which is also shown on the sketch. The

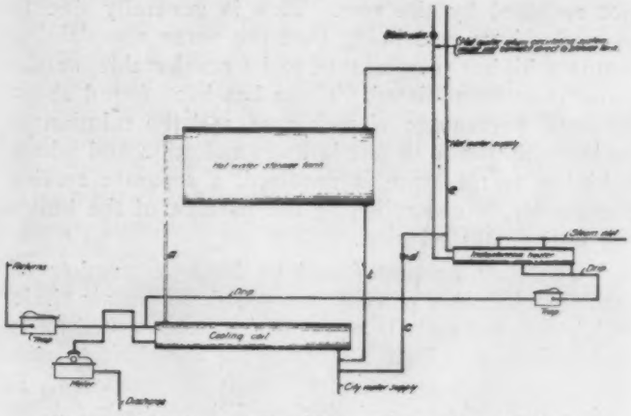


Fig. 1. Diagram of Hot Water Connections Without Thermostatic Control.

instantaneous heater always adds some heat to the water as it passes through, depending on the temperature of the water in the storage tank. It would be too hot if taken direct from the instantaneous heater, so a small amount of cold water is added, this amount being practically a constant percentage of the water being used, and as this percentage can be regulated, any temperature of water can be furnished. A thermostatic control, valve can be used as shown on Fig. 2, which will automatically maintain the water at any desired temperature, and is, in many cases more economical.

A few examples will be given of representative buildings. These examples show that satisfactory results are obtained from central station steam service. While money can be saved with its use, a big item, that of "service," is hard to estimate in money.

**Case A.**

A fairly modern hotel, well built, 3 years old. It has 3650 square feet radiation and 640,000 cubic feet space.

| Fuel Cost Only. 1913. | | Central Station Steam Net. 1914-1915 |
|---|---|---|
| January | $194.60 | $145.58 |
| February | 174.65 | 118.58 |
| March | 124.75 | 80.00 |
| April | 99.80 | 67.86 |
| May | 99.80 | 55.10 |
| June | 24.95 | 31.50 |
| July | 24.90 | 40.50 |
| August | 49.90 | 44.01 |
| September | 49.90 | 71.28 |
| October | 99.80 | 99.50 |
| November | 123.75 | 123.53 |
| December | 212.54 | 132.43 |
| | $1179.34 | $1009.87 |
| Saving | | $ 169.47 |

A saving in this case was made in labor amounting to about $1200 per year in addition to the above fuel saving, making a total saving of about $1370. It will be noted that in the milder months of winter and in summer the central station service exceeded in cost the amount paid for oil fuel for the private plant. This is explained by the fact that with central station service better heating is enjoyed at all times, and hot water being available, very much more is used, giving the hotel tenants a much more satisfactory service in every way. Rather than start up the private plant to take care of an unexpected change in weather, the people are allowed to bear with their inconvenience, while with central station service the heat is at hand when you need it, 2 a. m., July 4th, as well as at dinner time on Christmas Eve.

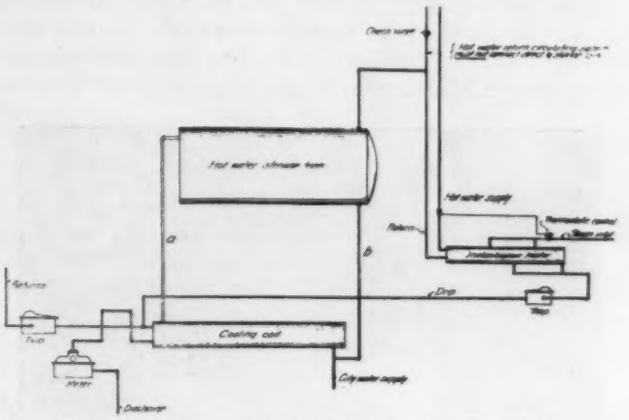


Fig. 2. Diagram of Hot Water Connections With Thermostatic Control.

We will now consider a second actual installation:

**Case B.**

Office and Club Building, has 855,600 cubic feet space; 7007 square feet radiation. We have only served them for part of November, all of December, January and February. Basing an estimate on what has been required to date, heat will cost them about $3000 per year. Oil had cost them about $4250 per year. The skilled labor is now applied in other directions which has been estimated to be worth over $900 per year to the building, which would make a total saving of over $2000 per year.

**Case C.**

Office Building: It has 152,000 and 1321 square feet radiation. Steam heat has been furnished for just one year, and cost $520 for that year. The previous year's fuel cost had been $438.40 and $520 for labor, making a total cost of $958.40, a saving of $438.40.

Every case must be given special consideration after the application of broad general principles.

To use central station heat requires educating the consumer, especially if he has had his own plant. With his own plant he has been in the habit of letting his fire die out if the weather gets warmer during the day, but with the central station steam there is no reduction of consumption unless turned off, as the steam is sold by weighing the condensation. We have found places where 80 per cent of the windows of a building were wide open to keep the rooms comfortable, and the owner would not think of shutting off the steam. This has been overcome in many buildings by careful supervision or by installing automatic regulation. The automatic regulation has proved to be the most satisfactory, as a very uniform temperature can be maintained.

The complaints we have had were of all kinds. In a few cases complaints were received that they had no steam heat, and it has been found that the only trouble was that the radiator was shut off, or that they had shut off the main valve, and did not think to turn it on.

One peculiar complaint was that our steam was not as hot as that from their own system. No question of superheat entered into it, because they could

not make superheated steam with their own system. The way the party tried to prove his contention was, that he could hold his hand in a jet of the central station steam, but could not do so with their own plant. Investigation developed that he did not know there was a difference between the temperature of the fog (condensed steam in suspension) and the point where the steam would issue through an opening.

Most vacuum systems can be easily converted into a plain gravity system, and with central station steam this is often far more economical. In one case reported the old engineer of the building insisted that he must run his vacuum pump in order to get results.

2400 Volt Switches and Bus Structure.

He claimed that the radiators would not heat the building without it. Actual tests conducted by the distributing company indicated that it was absolutely unnecessary to run the pump, hence a waste of power to keep it in service. The engineer was a man with whom you could not argue successfully and it was not desirable to go over his head, so the pump was connected up in a way that its operation did not interfere with the heating system. For two months the pump was run in order to help out the central station heat. The engineer explained from time to time how this was the only way to heat the building as desired. As a matter of fact the building was not warm to him even though the thermometer read high, if the pump was not working.

In one case where an automatic temperature regulator was installed a complaint was filed, after several days' successful operation, that the house was cold. Investigation proved that the temperature was 70 degrees but that the radiator was cold when touched with the hand. This was due to the fact that steam had been cut off completely for the time being and hence the tenant felt cold regardless of the actual temperature. No further complaint was recorded from this locality after the system was fully explained and instructions given to watch the thermometer and report when it fell below a certain point.

Many changes have been found necessary in some buildings before the steam could be used economically. No attention is paid in most private plants to keeping the motor valves in order where they are used. With a private plant this does not represent a serious loss, but with central station steam it generally means unnecessary consumption.

Another serious loss is caused by one or two tenants or roomers in a building demanding heat when not required by the rest. This is generally due to several things, one being that the party complaining wants a higher temperature to be comfortable, or the room is under-radiated. There has been found about an equal percentage of each case, and the solution of under-radiation is to put in more radiation and where a higher temperature is required, a separate service independently controlled of the balance of the building is the only solution.

One building was found to have a number of rather large pipes running up and down an air shaft, which was connected direct to the steam service. It was intended to heat the air in the air shaft to produce a circulation of air for ventilation purposes. It took some time to find this condition and had been using a large amount of steam. It was cut out, and if at some future time it should develop that ventilation is required, a small fan will handle far more air than the draft furnished by the heated air, and very much more economically.

Taking all things into consideration, the central heating plant will be a vast benefit to the city. It will give a service much needed to bring it up to the standards of larger cities with more modern ideas. The matter of smoke is materially reduced, as it is a self-evident proposition that a big concern can better afford to keep experts to prevent the smoke nuisance. It has been proved by careful examination in Eastern cities that goods are much less shop worn where central station steam is used, as the smoke, soot, etc., from the private plants cause damage. No accurate data on costs have been compiled at this date, but will be available later.

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**Commission jurisdiction** has been extended over all public utilities in all cities of California, except such as are municipally owned, by the Carr bill, which has received the governor's signature. The California Railroad Commission will take over its new rate-making powers ninety days after the legislature adjourns.

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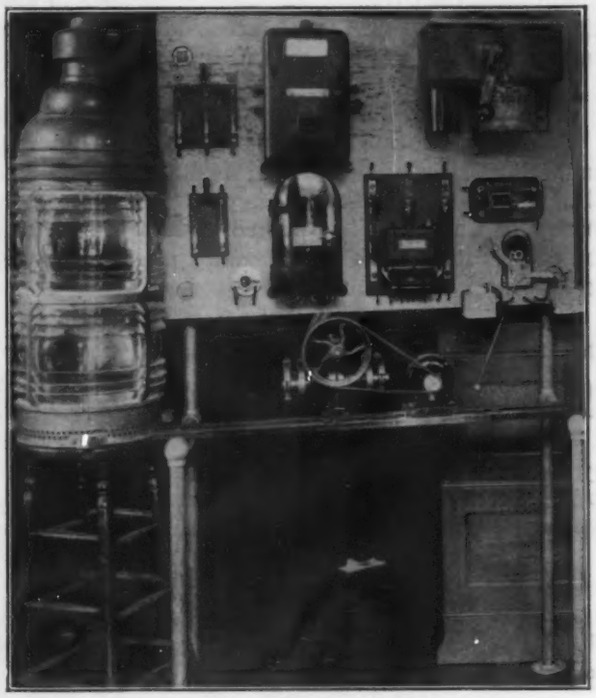
**The Dey electric vehicle** is a new type of electric automobile recently developed in New York City to meet the demand for a light machine at a low price. A three-passenger runabout weighs less than 1200 pounds and costs about $750. The driving mechanism is a part of the rear axle; the field of the motor rotates and drives one rear wheel, and the armature drives the other, thus doing away with a differential gear. Braking is accomplished by coasting against the motor, which thus becomes a generator feeding the batteries.

## NEW SWITCHBOARD DEVICES DESIGNED BY THE U. S. LIGHTHOUSE SERVICE.

BY D. W. DAY.

*(After a brief description of light and fog signal installation on Angel Island, the author describes an ingenious automatic switching device and a novel remote control switch. These were devised by Mr. Day, who is connected with the 18th Lighthouse District.—The Editor.)*

Two interesting and rather ingenious electrical devices have recently been installed at Angel Island, in San Francisco Bay, in connection with the establishment of two lights and fog signals by the 18th Lighthouse District. Angel Island lies in line with the northern edge of Golden Gate Strait, and consequently gets the full sweep of the tidal currents to and from San Pablo Bay, the deepest part of San Francisco Bay lying to the north of the island, in Racoon Straits, where there is a depth of over 200 feet. These



Lantern and Control Switchboard.

tidal currents at times attain a speed of from 5 to 6 miles per hour, making navigation around the island dangerous during foggy weather.

A light and fog signal have been in operation for many years on the western side of the island, where there is a dwelling for a keeper. But these signals were not of much help in going around the island to the north or south. Therefore it was decided to place additional signals at either end of the island and have them controlled from the keeper's dwelling, lying about midway between the two, one and one-half miles from the northern, and two miles from the southern set.

Three-phase 60 cycle electric current at 11,000 volts pressure is brought over from the mainland by a submarine cable to the northern end of the island, and from there it is carried on poles around the island to the east side, passing within 2000 ft. of the keeper's dwelling and the two signals. Transformers reducing from 11,000 to 240 volts were placed on this line at points nearest the two signals and power carried from there to the switchboards in the signal houses.

Each set of signals consists of flashing electric incandescent lamps inside of lanterns, and electrically driven sirens. The lamps are 500 watt Mazda globes, flashed on and off by means of electrically driven sign flashers; their starting and stopping times being con-

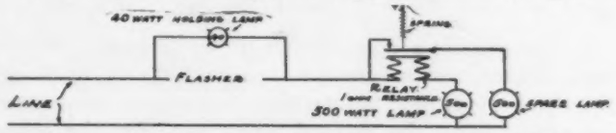



Fig. 1. Automatic Device for Cutting in Spare Lamp.

trolled by time switches. The sirens are operated by 2 h.p. 3-phase motors, and are controlled from the keeper's dwelling by means of mechanically held remote control switches; the ones installed being the General Electric Company's type R, form C2, which has two solenoid coils, one for opening and the other for closing the switch. It is in connection with the operation of the lights and the control of the siren motors that the new devices have been developed.

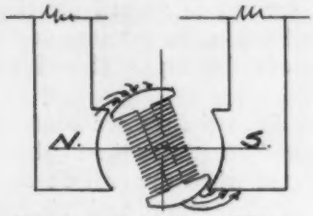



Fig. 2a. Position to Which Magneto Armature Would Turn if Free to Move.

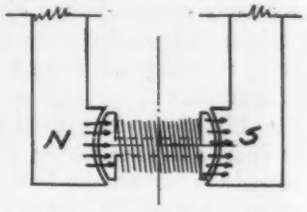



Fig. 2b. Position in Which Armature is Normally Held by Weighted Arm.

In order to provide against the contingency of a lamp burning out at night and not being replaced by the keeper, two lamps, one above the other, were placed in the lanterns, and an automatic switching device placed on the board which would switch in the spare lamp in case the regular lamp burned out.

This device, shown in the diagram (Fig. 1) consists of a telegraph relay with laminated cores, rewound for one ohm resistance, and a 40 watt tungsten lamp.

The current from the flasher flows to one binding post of the relay, and from there it has two paths, one through the relay coils to the regular lamp, and the other, through the sounder of the relay to the spare lamp. This latter path, however, is broken when the sounder is attracted to the coils by the magnetic field set up in the relay, and so the spare lamp does not light up. When the flasher shuts off the current the sounder would normally return to its original position, but it is prevented from doing so by the holding lamp which is cut around the flasher and furnishes just enough current to hold it to the coils. In case, however, that the regular lamp burns out, no current can flow through the coils of the relay, consequently the sounder returns to its normal position and allows the spare lamp to light when the next flash occurs.

The other device on the board, namely, the one for operating the remote control switch, was evolved because of the expense that would have been incurred

for poles and wire had the remote control switches been installed in the ordinary manner; i.e. with three wires from the switch to the point of control. In this instance, the three wires would have necessitated a total of over ten miles of wire, so a scheme was devised whereby the remote control switch could be operated over one wire, (a length of 3½ miles) and this wire was carried on brackets on the power pole line.

The principle upon which it works is the following: Direct current from a d.c. magneto in the keeper's dwelling is sent in one direction or the other over the single wire, the ground being used for the other lead, to a standard 5-bar telephone magneto mounted on the switchboard. This magneto has its armature held out of its normal position by a weighted arm and mounted on this arm are contacts which can dip into mercury cups on either side of the magneto.

By energizing the armature in one direction it is caused to rotate, closing one set of contacts to the mercury cups. Reversing the direction of the current to the armature reverses its direction of rotation, and causes the contacts to dip into the other set of mercury cups. When the current is turned off the weight brings the armature back to its original position, opening the circuit across the cups. (See Fig. 2a and 2b.)

Fig. 3 shows the wiring from the remote control switch to the mercury cups, and illustrates the method by which the switch is operated when the arm on the magneto dips to one side or the other and short-circuits the mercury cups.

In order to assure the keeper that the signal is working properly a telephone which is left with the receiver off the hook is installed in each signal house beside the siren. This telephone is grounded and connected to the magneto control wire through a condenser, the condenser being used to prevent the direct current for operating the switch from flowing through the telephone.

The photograph shows the switchboards that were installed at the signals, and also the lanterns that were used. Referring to the numbers on one of the boards:

No. 1. Main power switch.
No. 2. Meter.
No. 3. Oil switch to protect siren motor.
No. 4. Light circuit switch.
No. 5. Holding lamp for switching device.
No. 6. Time switch for light. (See Fig. 1.)
No. 7. Remote control switch.
No. 8. Relay switching device. (See Fig. 1.)
No. 9. Magneto control for No. 7. (See Fig. 2 and 3.
No. 10. Flasher for lights. (See Fig. 1.)

The devices described have been in operation since the 15th of February, or about two months, and so far have not given any trouble nor have they shown any signs of deterioration in power or positiveness of operation. No specially designed apparatus was used, standard articles with slight modifications to fit their new duties being used throughout. There is the possibility, however, of designing something along the lines here indicated, especially in the case of the remote control switch extension that would meet the needs of the trade, especially in cases like the above where there are considerable distances between the point of control and the operating switch.

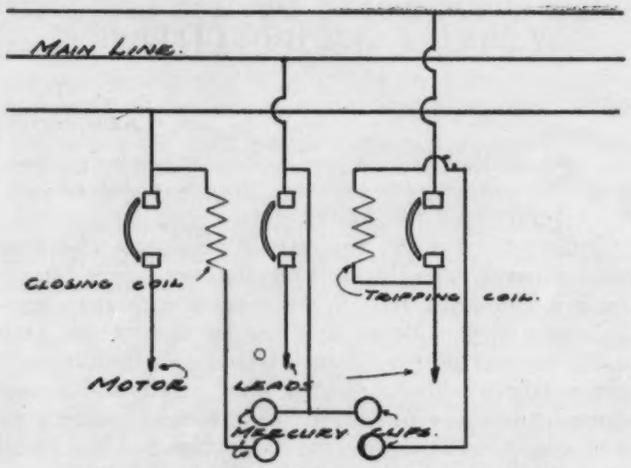



Fig. 3. Wiring Connections for Remote Control Switch, Signal Switchboard and Lantern.

## ELECTRICAL OIL PUMPING.

Some interesting comparisons as to oil pumping methods and costs is contained in the California State Mining Bureau's recent bulletin on the "Petroleum Industry of California." Detailed figures are given of the comparative costs with steam, gas and electricity as follows:

**Comparative Cost Per Well.**

| | Steam. | Gas. | Electric. | |
|---|---|---|---|---|
| First Cost | $1158 | $1360 | $1000 | $1212 |
| | Estimate. | Actual. | Estimate. | Actual |
| Fixed charges per day | $ .81 | $ .25 | $ .39 | $ .22 |
| Operation and repairs per day | 3.16 | 1.78 | 2.71 | 2.06 |

Comparison of pumping cost in the Midway field by electricity and gas engines is shown by the following monthly figures on two groups of wells under the same management:

| **Electricity.** 12 wells, oil 17 degrees B. Depth, 1360 ft. | | **Gas.** 13 wells, oil 17 degrees B. Depth, 1300 ft. | |
|---|---|---|---|
| Equipment (Motive Power.) | | | |
| Electric motors (installed) | $11,247.86 | Gas engines, 9 | $11,039.04 |
| Gas lines | 540.42 | Steam engines, 2 | 1,000.00 |
| Power lines | 2,409.97 | Gas lines | 3,603.81 |
| | | Steam lines | 321.82 |
| | $14,198.25 | | $15,964.67 |
| Per well | 1,183.19 | Per well | 1,228.05 |
| Operation. | | | |
| Labor | $308.24 | Labor | $438.79 |
| Electricity | 354.52 | Water (elec. and gas) | 166.80 |
| Miscellaneous | 38.72 | Miscellaneous | 57.29 |
| Total operation | $701.48 | Total operation | $661.88 |
| Per well day | 1.95 | Per well day | 1.69 |
| Repairs (Wells.) | | | |
| Labor | $182.15 | Labor | $342.54 |
| Material | 58.16 | Material | 283.78 |
| Total repairs | $240.31 | Total repairs | $626.32 |
| Repairs per day | 0.667 | Repairs per day | 1.74 |
| Total operation and repairs | $941.79 | Total operation and repairs | $1,288.20 |
| Per well day | 2.62 | Per well day | 3.30 |

When gas is used it is collected by means of traps from such wells as are able to furnish it and piped to the various engines at each pumping well. Unless used on the property it is usually wasted and its cost regarded as nil.

Pumping by electricity is accomplished by individual motors and a central transformer plant. Power is furnished at from 1.5 cents to 1 cent per kw.-hr., according to the number of motors in use.

# INDUSTRIAL USES OF FUEL OIL

BY F. B. DUNN.

## The Rotary System of Burning Oil.

One of the earliest methods of atomizing employed by engineers in experimenting with the use of oil as a fuel was the centrifugal action of a rapidly rotating jet. French engineers, during their early trials, constructed a device that employed centrifugal action for spraying the oil, and used low pressure air as an atomizer. The oil used during these tests was similar to coal oil. It was not possible to operate the burner without the formation of large volumes of smoke; and the evaporation of water per pound of oil was only 8½ lb. The mechanism was cumbersome and expensive.

During the tests conducted by the U. S. Naval Liquid Fuel Board under a Hohenstein boiler, the question of using the rotary method was given special consideration. As the possibilities of spraying oil by means of centrifugal force looked feasible, a burner was designed to utilize a ring of buckets which was formerly part of an experimental steam turbine. In this turbine there were five rings like the one used in the burner. The turbine was compounded in such a way that the outputs of power from the five rings were equal. The turbine, at a speed of 15,000 revolutions per minute, gave 20 horsepower. By the use of diverging steam nozzles the single ring, as used in the burner, should give an efficiency somewhat higher than one-fifth that of the compounded turbine. In other words, the burner turbine should, at a speed of 15,000 revolutions per minute, yield more than one horsepower on 100 lb. of steam per hour.

In designing the burner, however, the consumption of steam was assumed at 400 lb. per h.p.-hr. This was to allow, among other things, for the unknown viscous resistance of the film of oil flowing from the center of the disk to the periphery. Even with this seemingly ample allowance, only one-ninth as much steam should be required as in the simple jet burner. A number of tests were conducted, and many changes were made in the furnace and adjustments. The following extracts for the report will give the reader an idea of some of the difficulties that had to be overcome:

"Nov. 3, 1902.—Made a disk of sheet iron 1-16 in. thick and 10 in. in diameter, and fastened to burner in such a manner that the oil flows over its upper surface. Assembled burner and repaired circular furnace, making it 33 in. high and 4 ft. in diameter. Tried burner at 5 p. m. It seemed to work satisfactorily in all respects. The oil was able to protect the disk from overheating during the few minutes that the experiment lasted. Speeded up turbine without igniting oil and caught samples of spray on blotting paper.

"Nov. 8, 1902.—Repaired brick walls. Steam at 90 lb., oil at 25 lb. Turned on steam. The burner began spinning around, and soon attained speed. Ignited some kerosene-soaked waste and dropped it beside burner. Turned on oil. There was instant ignition. Stepped aside to observe the effect. More oil was being supplied to the burner than it could take and spray properly; much oil was escaping downward from the burner. Could not shut off the oil at the valve on account of intense heat. Ordered it shut off at the pump. Oil continued to flow on account of oil chamber on pump. Something exploded and demolished one side of the furnace. The turbine ring had broken loose. The ring was nearly driven onto the cast iron center. The heat and centrifugal force had been sufficient to expand it to the degree of making it loose. When it tore off the 19 in. disk, the cast iron center continued to spin for some time. Half of the buckets were torn off the turbine ring.

"Nov. 15, 1902.—Assembled the two-jet burner and connected pipes as before, instead of a brick wall around burner, two curved plates of boiler steel were used. The lower edges of the plates were lifted off the ground by the thickness of three bricks. The plates made an enclosure about five feet in diameter and four feet high. Turned on steam from the main boiler. Placed some oil-soaked waste on the ground within the enclosure and ignited it. Oil pump started and orders given to keep oil pressure at about 20 lb. When the oil valve was opened there was instantly an intense combustion within the enclosure; the heat was so great that the oil supply had to be reduced. The volume of the fire was as easily controlled as a common gas jet. After about five minutes the burner went to pieces, caused by the backing out of the supporting pipe where it screws into the pipe fitting on the pedestal.

"Summary.—The steam pivot burner was a failure from the start, and it is not considered advisable to attempt to correct its faults. The solid pivot burner failed at first because the oil was not thrown off from its greatest diameter, and afterwards because some of the oil escaped downwards and burnt underneath, thus heating the burner and finally from the parts not being securely fastened together.

### Conclusions as to Centrifugal Burners.

"First.—The oil should be thrown off from the largest diameter of the burner.

"Second.—The burner must be so arranged that the only outlet for the oil leads to the intended spraying edge. The construction of the experimental burner was such that part of the oil went wrong when the amount fed was greater than a certain maximum or less than a certain minimum.

"Third.—The oil should be introduced at the center of the spraying disk and flow over the whole of the surface exposed to the radiant heat.

"Fourth.—All parts should be secured by fastenings, which are more reliable than mere friction, however great; otherwise the very high speed of rotation will shake them loose.

"Fifth.—There is no evidence that the amount of oil flowing through the burner is not amply able to keep it at a safe temperature. In fact, the cooling power of oil, compared to the amount of surface of the burner is many times greater than the cooling power of water compared to the heating surface of a boiler. The ratio is from 25 to 200 or 300 in favor of oil.

"Sixth.—By leading the air required for combustion in along the burner head or burner mechanism, the inrush of air can itself be made to absorb much of the heat which the disk receives from radiation, the air thus constituting a cooling medium to the mechanism.

"Seventh.—These experiments were all conducted in the open air and some of them in the wind. Hence there were few of the benefits derivable from the presence of glowing furnace walls. How much this affected the results, is of course uncertain, but it is the opinion of many who witnessed the experiments that the presence of hot furnace walls would have resulted in a very great improvement."

Prior to the above experiments Mr. Milton A. Fesler of San Francisco, Cal., was conducting experiments with a rotary or centrifugal burner. He at once discovered that oil could not be burnt in a solid body or in a thin film or spray, without the assistance of an atomizing agent to break up the oil into minute atoms. The use of a steam atomizing agent would require a steam generator, and the expense of such a generator or the necessity of steam for atomizing was one of the items that he was trying to eliminate. The use of an air compressor was also considered as expensive and cumbersome. The local demand required an oil burner that could be started by a simple operation and that would not require constant attendance by the operator. The Fess system is the result of many experiments conducted in the laboratory of thermal research maintained by his company.

The Fess rotary crude oil burner is what might be called a "mechanical burner" due to the fact that the atomization is perfected by means of a rotary action without the use of steam or compressed air. The mechanism is driven by an electric motor mounted on a wooden insulating block on the base frame of the system; the bolts holding it in position are set in fibre insulating bushings, so that the motor is absolutely insulated from the base frame.

The universal joint in the shaft between the motor and the worm case allows perfect freedom of motion of the motor armature in its bearings without binding, due to any inaccuracy in the perfect alignment of the shaft. The bearings of the worm shaft in the worm case are lubricated by two oil rings which dip into the oil supply in the bottom of the worm case, which is constructed to form a reservoir for the supply of lubricating oil. The worm and gear are lubricated from the bottom of the gear, which runs below the surface of the oil in the reservoir. The worm operates against a ball thrust bearing in the worm case, composed of a race and two case hardened washers. All bearings are made of bronze with removable bushings. The worm is made of steel and the gear of bronze.

The oil pump is of the twin gear rotary pattern, entirely constructed of bronze, with a steel driving shaft connected to the worm gear shaft by a male and female slot. Special attention has been given to the size of the pump stuffing box. By disconnecting the two unions on the oil supply and discharge pipes the pump can be readily removed from the base.

The shaft between the worm gear case and the gear box under the boiler is a steel shaft fitted to the large gear shaft in the gear box by a male and female groove, and to the worm case shaft by a flexible, ball-centered coupling. By removing the four coupling screws and the set screw on the shaft, it can be entirely removed.

The gear box is the housing for enclosing the bevel gears which transmit the motion from the horizontal driving shaft to the vertical shaft supporting the revolving head. The large driving gear is supported on a shaft running in a removable bronze bushing carrying a ball thrust. The hollow vertical spindle is carried by a ball bearing consisting of a concave, case hardened race-way, and a case hardened flat washer, all housed by a removable bronze bushing. On the revolving shaft is a steel pinion meshing with the bronze driving gear carrying a hollow spindle into which the head spindle fits with a taper joint. Through the center of this hollow spindle is the oil stud spindle carrying the crude oil through the gear box and to the oil distributing disk of the burner head. By the splash system all of the bearings are automatically oiled, the overflow being carried back to the main reservoir.

On the bottom of the head or hub, is constructed the primary air fan, of the propeller type, which handles all the air that is supplied to the burner. At the top of the hub there are two sections of the secondary fan which are of the multivane type and they deliver the air both below and through the oil spray. The oil atomizing cup carries an oil trough at the bottom, undercut to retain constantly a thin film of oil, which by capillary attraction connects with the film of oil fed to the oil disk from the supply pipe in the hollow spindle. This forms a continuous ring of oil when the head is in motion and causes an absolutely even distribution of oil over the entire periphery of the oil disk at the point where the oil leaves the head and enters the furnace. This condition assures an even fire that will burn with a steady flame without puffing or going out. The top of the head is carried by the continuation of the oil feed spindle and is stationary. It is covered with a cap of fire-proof compound.

The fire-box end of the bed plate has four supporting legs carrying a cast iron floor plate, from which radiate floor irons supporting the fire brick of the furnace. Below the floor plate are two grooved guides carrying an adjustable air damper by which the air supply to the fans can be controlled, and perfect combustion of the oil maintained. The damper is operated by a rod extending to the front of the furnace. The bed plate of the machine contains milled grooves and pads by which the gear box and the worm case are accurately aligned and the gear box is held in place by a clamp screw which forces it against a stop at the rear end of the bed plate.

The starting device for the motor consists of a double throw spring lever switch, so arranged that in starting, the switch is thrown into the lower lugs, which are connected onto the line without fuses; after the motor has reached its normal speed the switch is quickly thrown onto the upper lugs. The motor is thus operating on a line connected through fuses of ample capacity. It is impossible to leave the switch on the lower unfused lugs, for the springs immediately throw the switch out if the hand is removed. A solenoid trips the switch upon any failure of the current, and the motor automatically stops. A separate switch is provided for each oil burner in the plant, and each motor is therefore entirely independent of the other.

To operate this system, it is only necessary to throw in the switch, watch until the oil is up to the required pressure, and then place in the furnace a small piece of lighted paper, which immediately ignites the oil. The pressure required on the boiler

can readily be adjusted by means of a siphon regulating valve which is connected to the oil supply valve by means of a rod. This system has been known to operate without any attendance, other than when starting, for months at a time.

While the Fess system will work perfectly under almost any type of boiler, it has been installed most in heating plants in hotels, homes, public buildings, schools and apartment houses. The reason for this is that it is entirely reliable and requires little attention. With other types of oil burning installations, a great deal of the attendant's time is required to adjust the burner to meet the fluctuations in the load on the boiler.

The following data are shown here in order that the engineer, architect, or owner may ascertain the approximate amount of fuel oil required for heating purposes in hotels, homes or apartment houses. Also the cost of oil is compared with that of other fuels, as wood, coal, gas, electricity or steam service from central supply stations.

**Table of Oil Required for Heating Purposes as Compared With Cost of Electricity, Gas, Coal, Wood or Steam Service.**

| Boiler Ratings. | | | Oil—gallons per day of 10 hours. | Sq. ft. of radiation. | Electricity at 5c k.w.-Hour. | Steam Service at 60c per 1000 lb. condensed water. | Pine Wood at $9 cord. | Gas at 70c per 1000 cu. ft. | Oil at 90c per bbl. |
|---|---|---|---|---|---|---|---|---|---|
| H.P. | Steam. | Equiv. hot water. | | | | | | | |
| 3.6 | 500 | 800 | 14 | 500 | $1.36 | $1.00 | $1.59 | $1.34 | $ .318 |
| 7.2 | 1000 | 1600 | 28 | 1000 | 2.72 | 2.00 | 3.18 | 2.68 | .636 |
| 10.8 | 1500 | 2400 | 42 | 1500 | 4.08 | 3.00 | 4.77 | 4.02 | .954 |
| 14.4 | 2000 | 3200 | 56 | 2000 | 5.44 | 4.00 | 6.36 | 5.36 | 1.27 |
| 18. | 2500 | 4000 | 70 | 2500 | 6.80 | 5.00 | 7.95 | 6.70 | 1.59 |
| 21.6 | 3000 | 4800 | 84 | 3000 | 8.16 | 6.00 | 9.54 | 8.04 | 1.80 |
| 25.2 | 3500 | 5400 | 98 | 3500 | 9.52 | 7.00 | 11.13 | 9.38 | 2.12 |
| 28.8 | 4000 | 6000 | 112 | 4000 | 10.88 | 8.00 | 12.72 | 10.72 | 2.54 |
| 32.4 | 4500 | 6800 | 126 | 4500 | 12.24 | 9.00 | 14.31 | 12.16 | 2.86 |
| 36. | 5000 | 7200 | 140 | 5000 | 13.60 | 10.00 | 15.90 | 13.40 | 3.18 |

This table is based on the following assumptions; by referring to the reports below on comparative consumption of the various fuels, it will be seen that the table is a fair average.

Electricity: Assuming that one square foot of direct radiation will heat an average of 50 cubic feet of space, then 500 square feet of radiation will heat 25,000 cubic feet. Figuring the heating value of one kilowatt hour at 3400 thermal units, and that 1 B.t.u. will raise the temperature of 54 cubic feet of air one degree, then 25,000 cu. ft. raised from 50 degrees to 70 degrees will require $\frac{25{,}000 \times 20}{54} = 9{,}260$ B.t.u. divided by 3,400 = 2.73 kw. at 5c per kw. = $ .1365 per hour or $2.66 for ten hours.

Steam service: Assuming that one square foot of direct radiation together with pipe, etc., will condense 1-3 of a pound of steam into water per hour, then, 0.3 divided into 500 will give the amount of steam required per hour or .1667 times 60c for steam = $ .10002 per hour or $1.000 for 10 hours per 500 sq. ft.

Pine wood: The average pine wood used for fuel is compared with oil as two barrels of oil being equal to one cord of wood; assuming that it costs .318c per day to heat 500 sq. ft. of radiation with oil as fuel at 90c per bbl. With wood at $9.00 a cord $2 \times 90 = 180$ divided into 900 = five times as much with wood or $5 \times .318 = \$1.59$ per day of 10 hours to heat 500 sq. ft.

Gas: Assuming that one square foot of radiation gives off 250 B.t.u. per hour, then 500 sq. ft. will require 125,000 B. t.u., or 1,250,000 for 10 hours. This divided by 650 B.t.u. contained in one cubic foot of gas will equal 1923 cu. ft. of gas required, at a cost of $1.34 with gas at 70c per 1000 cu. ft.

Oil: Assuming that one pound of oil will evaporate 12 lbs. of water and that 100 sq. ft. of radiation requires 33 1-3 lb. of water per hour, then 500 sq. ft. will require 166.6 lb., this divided by 12 will give 1.38 lb. of oil required per hour, times 10 = 138 lb. of oil daily. Oil at 90c per bbl. and 330 lb. per bbl. equals $.0027 \times 138$ or $00.373 cost of oil daily.

**Miscellaneous Data for Above Computations.**

One B.t.u. will raise the temperature of 55 cu. ft. of air 1 degree.

One sq. ft. steam radiation gives off from 240 to 280 B.t.u. per hour.

One sq. ft water radiation gives off from 150 to 170 B. t.u. per hour.

One sq. ft. of average radiating surface under standard conditions condenses ¼ lb. of steam per hour, surrounding air being at 70 degrees F.

One sq. ft. of active heating surface will evaporate about 3 pounds of water per hour, from and at 212 degrees Fah.

34.5 pounds of water per hour evaporated from and at 212 degrees Fah. equals one boiler horsepower.

One "horsepower" will supply 138 sq. ft. of average cast iron radiation under normal conditions of installation, and under such conditions 4 sq. ft of radition is required to condense one pound of steam per hour. The hourly evaporation in pounds times four gives the heating power in terms of radiation.

If the rated capacity of the boiler is based on actual tests and you wish to find the horsepower, divide the capacity by 138. Thus: capacity—2,720 sq. ft. —divided by 138 equals 19.7 horsepower.

[To be continued.]

**The power absorbed by windage** of flywheels depends upon the number of revolutions per minute, **n**, the diameter of the wheel in inches, **d**, and the width of the rim in inches, **b**, in accordance with the formula: $\text{h.p.} = 10^{-16}\ n^3\ d^5\ [1.45 + 742\ (b/d)^2]$.

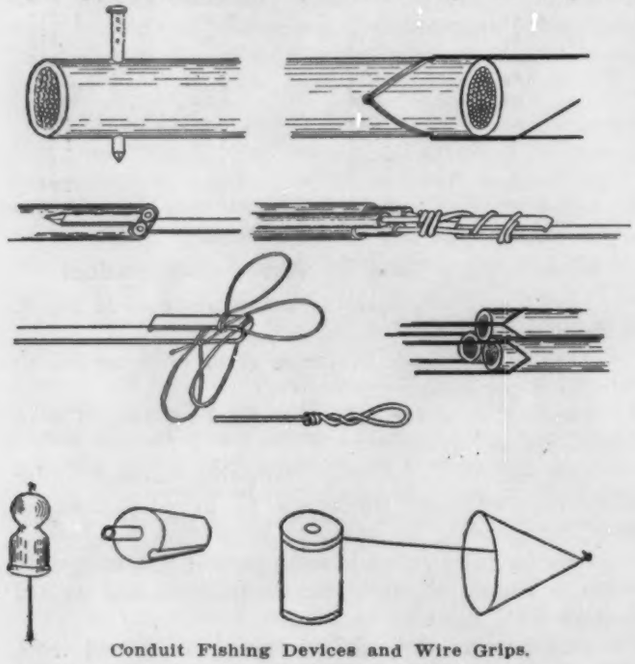
# INSIDE WIRING METHODS

By JOHN CARRELL

## Conduit Fishing.

Rigid and flexible conduit are installed to form a wire way into which the wire is inserted after all mechanical work on the building or structure is completed, as far as practicable. Various methods are employed to get the wire in place. For small wires and short runs the conductors may simply be pushed into the tubing or a snake, usually of spring steel in ribbon form, may be first inserted and the wires attached to the steel. For long runs in large conduits a steel wire or a rope may be drawn in by means of the fish steel, proportionate in size to the stress to be exerted. In most cases, before the electricians do any wire pulling they must first put their steel through.

Fishing steels of ribbon or tape form come, ordinarily, in lengths of from 50 to 200 ft.; are No. 19 B. & S. gauge in thickness and from ⅛ to ¼ in. width, but may be secured in any desired length. Tempered



Conduit Fishing Devices and Wire Grips.

steel of round cross-section is available, also. In order that the steel may be readily inserted into the conduit and so that wire may be easily attached, the end is heated and turned into a hook. A little oil on the steel or oiled tape on the end facilitates fishing.

Long runs of conduit, especially those of large diameter, often impede the progress of the steel. A series of clove knots, or double half-hitches placed in a certain way, are tied on the steel hook, leaving loops between. A steel inserted from the other end of conduit may engage in one of these loops. Unless the knots are properly tied the hook should be taped shut, for in case of slipping the hook may lead the hitch, in which case it may not be feasible to draw the steel out.

There are several machines on the market for conduit fishing. One type operates by means of compressed air and inserts a string, attached to washers, through the duct. Another type unwinds a fish steel from a reel into the conduit and withdraws on rewinding. It is operated by hand.

Where there is compressed air on a job a string may be readily blown through a duct. For small conduits a nipple of the nursing bottle type is attached to a chalk line; a tapered plug made to fit the conduit, with a groove in side for string and a tube in the center for a small hose, forms the equipment. For conduits of larger size a light rubber ball with a large section cut away takes the place of the nipple. These devices should work well in place of the washers furnished with pneumatic fishing machine because the air keeps the nipple or ball inflated and there is plenty of "give" to the sides.

Sometimes it is found impossible to get a steel through a pipe of large diameter and there are no facilities such as compressed air on the premises. Try a short paper cone with a thread attached. The cone should fit snugly in the duct. It may be blown through with bellows, after which a larger string may be drawn through and finally the pull-wire or rope.

When the steel appears at the outlet the man at the feed end strikes the conduit with his pliers (which means, stop) attaches the wire, strikes the conduit twice and feeds. To attach duplex wires for short runs a knife incision is made through the outer covering between the two conductors into which the steel hook is placed. If the runs are long the ends are skinned and hairpin loops made around the hook; some of the ends are wrapped around the loops and one around the hook to keep it closed.

Wire grips for large conductors are important things. Electricians often remove a section of insulation and twist the strands into a loop, at times soldering it, if the pull seems difficult, which is a waste of both time and wire. Others use a lacing of bailing wire such as underground men employ, but this method increases the difficulty in pulling wires around elbows. Something which may be new to many contractors is the fact that a spike may be readily driven through a stranded conductor. Drive one spike about 4 in. from the end; drive a second spike about 2 in. from end, but at right angles to the first; withdraw both spikes and lace with fine steel wire. Several strands of fine steel wire such as is used to tie metal lath will make an excellent hitch. (Standard Underground Cable Company Catalogue).

For the pull wire, where the use of the fish steel is not feasible, a No. 10 galvanized steel wire or a stout sash cord may be of service; for heavy work one-inch Manila rope is employed.

The 1915 Code will specify the size of conductors which may be drawn in the several sizes of conduits. The table is substantially the same as adopted by the National Association of Electrical Contractors and sufficiently well known.

Inspectors discourage the use of oil on wire pulled in conduit because its presence in quantity will destroy rubber insulation; but the wireman knows that

a slight trace of tallow applied to the outer braid will make the wire slide easy and for that purpose is worth a ton of the inspectorially sanctioned soapstone, especially if the runs are long or the conductors large. An inspector happened to visit a certain job while some large feeder circuits were being drawn in and took a position near the feeding end of a duct where the pulling promised to be hard at best. All the usual schemes to divert attention to other parts of the installation failed and as there are usually several men employed on this work the killing of time becomes expensive. Finally a bright idea struck the foreman: "Get an old sack to wipe the plaster from that wire." A helper obeyed, returning with a sack having a dab of tallow concealed therein. The wire was thoroughly cleansed and incidentally made sleek just as it was fed in the conduit. The inspector made favorable comment on the great care exercised, and the wire went in.

## DISTANCES SAVED BY CANAL.

From Colon, on the Atlantic side of the Isthmus of Panama, to Balboa, on the Pacific side, the distance by water, around South America, is 10,500 nautical miles. Through the Canal that distance is reduced to less than 44 miles. The difference in length of these routes, 10,456 miles, represents the maximum distance that can be saved to a vessel by use of the Canal.

What counts in the commercial value of the Canal is not the distance that could be saved but the distances that are saved, by vessels substituting the Canal route for the earlier 'round-the-continent route in regular trade. Following are some of the savings on great trade routes, between important areas:

New York, for instance, is nearer to San Francisco, through the use of the Canal, by 7873 nautical miles. The distance of 13,135 miles by Magellan has been reduced to 5262 miles by the Canal.

The Canal makes San Francisco nearer to Liverpool by 5666 miles, a saving of two-fifths of the old journey by Magellan. The distance between San Francisco and Gibraltar has been reduced from 12,571 miles to 7621 miles, a saving of 4950 miles or 39 per cent of the former distance.

From San Francisco to Buenos Aires, via Valparaiso and Magellan, is approximately 7610 miles; which is shorter than the route through the Canal, by which the distance is 8941 miles. To Rio Janeiro, the distance via Magellan is 8609 miles; by the Canal, 7885 miles. To Pernambuco, on the eastern promontory of South America, the distance via Magellan is 9748 miles; via the Canal, 6746 miles. To Para, the distances via Magellan and via the Canal are 10,852 and 5642 miles, respectively.

As to the Far East, New York is nearer to Yokohama by 3768 miles than formerly by way of the Suez Canal, but the latter route is 18 miles shorter than the Panama route for vessels plying between New York and Hongkong. New York is 41 miles nearer Manila by Panama than by Suez, and 3932 miles nearer Sydney by Panama. New York is now, by virtue of the Panama Canal, nearer than Liverpool to Yokohama by 1880 miles, and nearer than Liverpool to Sydney by 2424 miles.

## ELECTRIC UTILITY FINANCING.

*(Discussion on paper presented by Geo. K. Weeks before San Francisco Section American Institute of Electrical Engineers, Feb. 26, 1915; paper was published in this journal under date of March 20, 1915.—The Editor.)*

(Concluded.)

**W. G. Vincent:**—The speaker mentioned one fact respecting stock on which I would like a little explanation, and that is as to non-assessability. It is generally understood that stock is assessable. Just what is the legal situation regarding the non-assessability of stock? Is it a definite situation?

**Geo. H. Weeks:**—I might call on my friend Mr. How, who is sitting here tonight. He is an attorney. I don't know whether he would charge us for an opinion on this subject or not.

I will be glad to reply to Mr. Vincent's inquiry as best I can; but before I get to that I am moved to make a little further comment along the line of Mr. Halloran's very excellent remarks. There is no doubt that the answer to the question of where we are going to get this money is the matter of public confidence. Now, as I tried to bring out in the first part of my paper, public confidence is a matter of a great many factors; and there is both cause and effect between the public's attitude toward the utility and the method in which it has been and is being financed.

There is no doubt about the fact that there are these two schemes or theories of the operation of a privately owned utility; there is what might be called the old theory; and it perhaps was the necessary system in any pioneer enterprise—the system under which a man took a chance, and recognized that he was taking a risk only because he expected to make a profit commensurate with the risk. When he built an electric railway line in connection with a real estate operation and he made good he was a public benefactor, and he profited more than five, six or eight or ten per cent on his investment, if he showed good judgment. That is the conception of utility operation that undoubtedly prevailed when most of these utilities were started and when a good deal of the original money was put in. We have now come apparently pretty definitely in this country to an era of close public regulation, which per se seems theoretically fair enough, and would probably be workable if the money were put in under the theory now laid down. For instance, to be more definite, Mr. Eshleman, I believe, our lieutenant-governor and former president of the railroad commission, worked out a very nice theory on the same subject that I discussed of the relation between bonds and stock. He said, "Here is a utility that represents an investment of $100,000. Now, if we allow that utility to earn eight per cent on the investment, that utility ought to be able to borrow $75,000 on bonds at not to exceed 6 per cent interest, possibly less. We will allow them to earn eight per cent on the $100,000 or $8000. They borrow $75,000 at 6 per cent, which costs them in interest $4500 annually, leaving $3500 annually available as return on the balance of $25,000 stockholders' investment. That is equivalent to an earning of 14 per cent on the $25,000 which theoretically should be put up by the stockholders." I am inclined to feel myself that that system might be practicable in an established industry where the utilities were protected against unforseen contingencies which might arise, but the two systems—the old system and the new—do not harmonize; and I believe that there is a very real injustice, as Mr. Baum says, in trying to establish bodily the new system, and make subject to it capitalists who put in their money and took a risk, and many if not most of them failed because they were not able to see the development through.

Insofar as we may educate public sentiment, I think it is proper to educate public sentiment—while we may be drift-

ing towards the precise and scientific regulation that Mr. Eshleman describes, and while we are undoubtedly living under it, to educate sentiment on the part of our legislators and our citizens and our commissioners and so forth, to consider the problem from its inception, and to recognize the position of those who did build up a hazardous enterprise, and to some extent are still conducting a hazardous enterprise, and are entitled not on results based on a theoretically safe condition, but to a proper return figured on actual existing conditions.

Now to come down to Mr. Vincent's inquiry, my understanding of the situation as to preferred stock (and Mr. Bosley is apparently the high priest of this particular development), is that in California stockholders are responsible for the debts of a corporation incurred at the time they are stockholders, and that responsibility, as I understand it, they cannot escape. The situation, however, that has confronted stockholders and is confronting them today in many of our utility enterprises, is that the company faces a credit situation or emergency when it cannot borrow money, and the only recourse is an assessment on the stock. That is something separate and distinct from the claim of an actual creditor. It is simply a case where the directors of a company find that for the best interest of the corporation, for the proper conduct of its business, money must be raised, and the only way to raise it is to assess the stockholders, which the directors have the power to do. Now the non-assessability of preferred stock, which is indicated in my paper, seems to me only just and right, and the reason for it I think you all realize, but I will pause just a minute to elucidate that.

Suppose we have a corporation here with $10,000,000 of preferred stock. The conditions of the charter in an ordinary case are that the holders of the preferred stock are entitled to 6 per cent dividend from the earnings of the corporation; and in the event of liquidation are entitled to the par value of their stock. That is all they are entitled to and that is all they can ever receive. This corporation has ten million of 6 per cent preferred stock and ten million dollars of common stock. Now it faces an emergency, and the directors levy an assessment of $2,000,000. Under the old regime the preferred stockholders would have to put up their pro rata of a million, and the common stockholders the same. The preferred stockholders could never get any more back than they were originally entitled to—their 6 per cent and par value in the event of liquidation, whereas they have created an equity of one million dollars, they have helped to create an equity of two million dollars, which is invested in the property of the company, and is an asset; and, like all other assets of the corporation, after the preferred stock is taken care of, belongs to the common stockholders. In other words, the preferred stockholder, if he pays an assessment, can never get it back. He is simply building up an equity for the common stockholder.

That condition has caused to be worked out during the last two or three years in California the practice of including in the articles of incorporation or the by-laws a provision which has the force of a contract between the purchasers of the preferred stock and the officers and directors of the corporation; under which the directors have no authority to levy an assessment on that preferred stock. That, as I say, is entirely separate and distinct from the liability of all stockholders for the debts of the corporation. The latter is something that no stockholder, either common or preferred, can escape. But this stockholder's liability is not a practical condition. I don't know of any stockholder, except in the case of a few banks, who has ever been "stung" through a suit by creditors. It is an impractical remedy in the case of a corporation having thousands of stockholders; whereas the assessability by the directors for corporate purposes—for extensions and anything that is proper, is a real condition which many of our public utilities have faced—some of our largest power companies, and one of them is today levying such assessments upon its stock; and it is to escape that burden which they cannot get back—an unjust burden against the preferred stockholders, that this non-assessable feature has been adopted.

**C. L. Cory:**—I have a little information that may be of interest to you in reference to what Mr. Halloran has suggested about the policy of municipalities to continue investments in public utilities. Under my direction some eighteen months ago an investigation was made of the obligations of forty of the largest cities in the United States for each of the previous ten years.

The results of that investigation can be indicated very briefly as follows:

Per capita, even with the great growth of the urban population of the United States, the bonded indebtedness of these forty cities had increased seven times during that period. When a careful investigation was made as to the way in which the money had been spent it was found that in the majority of instances the largest sums of money had been expended to acquire the privately owned domestic water supply systems, and to provide very much more extensive educational facilities called for by the development during that ten-year period.

On the assessed valuation of these forty cities the bonded indebtedness had increased during this ten year period a little more than three times. There are two cities in the United States that are decidedly interesting as regards their debt. One is the largest city in the United States—New York. Its debt is not very different from the National debt. The interest paid, however, is between two and one-half and three times as much as is paid by the United States government. The other remarkable exception is the city that is very well known as the largest producer of our new vehicle of transportation—the automobile, Detroit. That city increased enormously in population during that ten-year period; it increased enormously in assessed valuation. That one city is notable among all others as not having materially modified either its debt per capita or its debt per dollar of assessed valuation.

Of course averages are very dangerous; we all know that, as engineers; but specific cities were investigated rather carefully, and all that Mr. Halloran brought out is unquestionably true. Municipal bonds of some cities, it would seem, will have to be rather critically investigated if these conditions continue.

**Jared How:**—I am seldom deliverately given an opportunity to talk upon this subject because it is too well known that I do not know when to stop. I have listened to discussions by engineers, by men engaged in the business of finance, and by lawyers. In my judgment nobody gets to the meat of the question—to the fundamental error under the application of which men in your profession are suffering. It is the doctrine fully established by commissions and by the courts, and fully acquiesced in by most lawyers, that public servitors are subject to complete power of regulation by the people and that the sole limitation upon the exercise of that power is that the property of the public servitor shall not be taken from it without compensation. In the construction and application of this limitation lies the fundamental error.

It has been the rule from early times that one who engages in the business of furnishing something which is necessary for the welfare of the general public, shall not take advantage of that necessity by charging, for that which he furnishes, an excessive price based only upon his power of extortion. If, for example, one has the only available supply of water, he may not charge for it a price controlled only by the consideration that the people must pay what he asks

because the people must have water or die. This is an exaggerated example, but it serves to illustrate the source of the principle.

The rule never has been, and it never ought to be, that the public servitor shall not be allowed to charge what, under all the circumstances, it is fair and just for the people to pay; but in the determination of what is fair and just for the people to pay, and in establishing a fixed rule, applicable alike under all circumstances, for that determination, the present wholly unsatisfactory condition of affairs has been created. The rule established is that the people—one of the parties to the contract of sale of the product of a public utility—shall declare the limit of the price to be paid for the service to them, and that whatever the circumstances attending the transaction, and whatever the value of the service to the consumer, that declaration shall be final and conclusive upon the servitor unless the result shall be to deprive the owner of the public utility of a fair net return upon the value of the physical property used by him in furnishing the service. This rule appears to depend upon the mistaken supposition that a public servitor devotes physical property, and only physical property, to the service of the public; whereas the fact is, clearly enough, that he gives to the public the product of a business—a business for the creation and operation of which factors as important as the physical tools by the aid of which the business has been established and is operated have been and are and must be continuously employed. For the use of these factors, however, no reward may be had.

To illustrate, let us suppose that you build a plant for the manufacture and distribution of electricity and lease it to the public. Certainly you ought to expect to receive as rent such amount as will provide a fair return upon the value of the property and a safe depreciation fund. But if, instead of leasing the plant to the public, you operate it yourself and endure all the labor and hazards incident to such operation, you are, under the application of the rule now firmly established, entitled to no more.

To illustrate further let us suppose that there are two owners actively competing in the business of generating and distributing electricity; and that the physical plants are worth substantially the same amount as measured by the present cost of construction. One owner through the exercise of unusual industry and foresight has acquired a very large business, and the other, with only ordinary ability, has been able to acquire only a much smaller business. The successful owner is limited to a fair return on the value of his physical property; and, obviously, the larger his volume of business, the lower the rates under which he can earn that return. The unsuccessful owner is, perhaps, permitted by law to charge higher rates than the successful owner because higher rates upon his smaller volume of business are necessary in order to provide to him a reasonable net return. But he is prevented by unerring economic laws from obtaining higher rates than his competitor. The result is that the industry and foresight of the successful owner do him no good whatsoever; and the sole result of his success is the destruction of the unfortunate competitor. There seems to be no available method of equalizing conditions between the two owners.

On principle it would seem that nobody should be denied the fruits of enterprise and endeavor in a business which is subject to regulation any more than in any other business. If you, who are interested in the business of distributing electrical current, manage that business so ably as to reduce to its lowest point the cost of the service which you render to your patrons, it would seem to be economically sound that you should reap a fair return for the employment of your ability; but the fact is that your success is reflected only in lower rates which you are entitled under the law to charge for that service. Your success, therefore, redounds to the sole benefit of your patrons to precisely the same extent as if you worked ostensibly for them.

The trouble is, of course, in the standard for the determination of the reasonableness of rates. Whether the public is being oppressed by unreasonable charges of a public service company should never rest solely upon the question whether out of its entire business the company is earning more than a fair return upon the physical property employed in the service; because that is by no means all that the company devotes to the public. It devotes energy, industry, foresight and other personal factors which have always been and which always must be recognized as entitled to such fair compensation as the results which they bring may justify. When I say that they always must be recognized as entitled to fair compensation I mean that they must be, if the best talent is expected to continue to be employed in public service enterprises; and that statement seems to be economically unassailable. It is clear enough, then, that the interest of the public which is to be served and which manifestly demands and requires the best and most efficient service, can be fully promoted only by a complete recognition of the industry and ability necessary for furnishing the best and most efficient service.

In 1901 Mr. Justice Brewer, delivering the opinion of the Supreme Court of the United States in the case of Cotting v. Kansas City Stock Yards Company, asked:

"Is it true in this country that one who, by his attention to business, by his efforts to satisfy customers, by his sagacity in discerning the probable courses of trade, and by contributing of his means to bring trade into those lines, succeeds in building up a large and profitable business, becomes thereby a legitimate object of the legislative scalping knife?"

It is patent from the form of the question that Mr. Justice Brewer would at that time have answered his own question by a negative. Today the question must be answered by an affirmative.

What passes my comprehension is the general acquiescence in this condition of affairs. It is astonishing that men of your profession who are engaged in public service have not uttered a protest long ago and continued to utter it until some relief appeared. The people are frequently unfair temporarily but can be depended upon to be fair ultimately. Lack of complete understanding is generally the cause of their unfairness; and it belongs to you and others who suffer from the present conditions to see to it that they have a complete understanding of the unjust effect of the present rules by the application of which rate regulation is carried on. It is barely possible that you have not fully understood the situation; and because of that possibility I have ventured to say what I have said.

I am reminded of my three-year-old boy who comes into my room each morning to awaken me. I had played bridge very late one evening and the following morning when he spoke to me I did not respond. He stood beside my bed and sang Tipperary. To that also I did not respond. Then he started to sing another song, but stopped in the middle of it and said impatiently, "Papa, can't you see that I am trying to wake you up?"

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**Free lamp renewals** is one of the subjects being investigated by the U. S. Bureau of Standards in connection with suggested standards for electric service. One of the clauses proposes that "Lamps furnished by utilities to customers without charge or at prices less than open market prices should be of such efficiency in watts per candle when used on the utilities circuits of standard voltage that the cost of light per candlepower hour to customers will not exceed the cost per candlepower hour when incandescent lamps are bought in the open market."

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### Factors of Safety for Boiler Operation

The interesting article to be found elsewhere in this issue covering an efficient steam heating system at Portland and the recent publication by the Boiler Code Committee of the American Society of Mechanical Engineers setting forth rules for the construction of the stationary boiler and for the ascertaining of its allowable working pressure give rise to timely discussion of the factors of safety to be employed in computing the maximum allowable working pressure to be put upon a boiler installation.

In order to prevent the operator from forcing his boiler beyond a reasonable limit a factor of safety is usually decided upon to determine a proper working pressure for his boiler beyond which he must never go.

The maximum allowable working pressure of a boiler or drum is determined from a consideration of the weakest course or seam of the boiler, for as in the case of the weakest link in the chain, so in boiler design the weakest seam determines the ultimate strength of the boiler.

The United States tables for governmental inspection of steamboat service are based upon a factor of safety of 3.5 for drilled holes, and 4.20 for punched holes, which are the lowest factors allowed in any civilized country. The factor in most European countries is either 5 or 6.

One of the most prominent of boiler inspection and insurance companies obtains the safe working pressure by using a scale of varying factors. Thus from 0 to 125 pounds boiler pressure a factor of 4.2 is used; from 125 to 150 pounds, 4.5; and for 150 pounds and over a factor of 5.

In the recently published report of the Boiler Code Committee above alluded to, a factor of safety of 5 is adopted throughout, both for high pressure boilers and for those producing low pressure generation of steam. It would seem that this systematic and flat footed declaration should meet hearty endorsement on all sides as presenting a reasonable, sane and safe solution for thus fixing the allowable working pressure for boiler operation as a safeguard to avoid the destruction of life and property that has occurred in the past, due to the adoption of less conservative units.

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### Get the Habit

In this day of commercial retrenchment the overhauling of office efficiency is of paramount importance. The early forty-niner could with perfect calm hydraulic or sluice rich gravel deposits and waste thirty or forty cents per yard. Today, however, when a gravel embankment yields only seventeen cents or less per yard, the waste material must be carefully scrutinized along with every other element that goes toward economic production.

This same intense necessity for lowering the cost of production is today being felt in all corporation life, especially in those corporations classified under the heading of public utilities, for if the managerial force is blind to certain sources of unwarranted expenditure, the regulating commissions are not long in pointing it out and insisting upon a betterment.

The habit of correct thought, the habit of correct dress, the habit of correct manner and the habit of correct routine attendance to duty constitute true efficiency in the conducting of human affairs. Habits are to the soul what the veins and arteries are to the blood, the courses in which it moves, and as Samuel Johnson has said the chains of habit are generally too small to be felt until they are too strong to be broken. Hence the supreme importance of welding a correct chain of habit when attending to the duties of life.

The habit of correct thought consists in having a loyalty toward your employer that is something more than a desire to please for what there is in it. It consists in breathing forth in a thousand littie ways wholesome ideas of encouragement to those surrounding you in your daily tasks and withal contributing your share to the esprit de corps of the organization.

The habit of correct dress consists in a modestly and suitably attired person arrayed with all the little niceties and refreshments without the fads and overdressings of the day.

The habit of correct manner is indeed the finishing touch that betrays the character for it has been well said that "manners maketh the man." Courtesy and thoughtfulness towards others are the foundation stones upon which the man of correct manners builds his superstructure.

And finally the habit of correct routine attendance to duty is the crowning jewel in the world of correct habits. Its possessor by well trained nerves of self control and by constant attention and concentration in business hours is enabled to perform all the daily annoying detail matters of business concern without confusion and with perfect calm, order and accuracy.

These habits, when once acquired, are indestructible. Indeed they are as indestructible as is the word habit itself, for where you take away the letter "h," "abit" is left; take away the "a" and a "bit" is still there; remove the "b" and "it" still remains; and when the "i" is cut out still it is not "t"-totally destroyed.

Hence we emphasize the motto "get the habit" and in your "getting," get a good habit.

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**South America as a Field for Engineering Activity**

The lands bordering on the Pacific present future possibilities for engineering endeavor hard to appreciate unless one has been an eye witness to these possibilities and personally inspected the gigantic resources openly observable on all sides.

A closer inspection, however, leads one to realize that the capturing of this engineering endeavor must come about slowly and grow with well earned confidences.

The nature of the country and the customs of the people must be thoroughly mastered, for often the engineer must unlearn, as it were, much of the knowledge he had previously learned in order to meet hitherto unencountered obstacles in human traits of a foreign people and in phenomena of nature, disastrous to hitherto known methods of engineering procedure. The driving typhoon, the sudden tropical downpour, the pestilence lurking in ambush to snatch away human life and the insect destructive to engineering construction, present new phases—all unknown to hitherto developed progress in engineering evolution.

In the editorial columns of our last issue comment was made upon certain natural phenomena that had to be overcome in the hydroelectric plant whose transmission wires pass at an altitude of 15,000 ft. above sea level in the high mountains of Peru, near the city of Oroya. The waters for the developing of this electric power drain from glaciers, some of which are at an altitude of 22,000 ft.

Peru itself is wonderfully rich in resources, but sadly undeveloped. Three times the size of France, it has but 1600 miles of railway, the best portion of which is owned by the same interests that control the hydroelectric plant above mentioned.

Although Peru as a whole is practically all mountainous, still it contains extremely fertile valleys, which are at present practically worthless because of lack of transportation. The west coast of Peru is decidedly a desert, but owing to its commerce the bulk of the people cluster about the sea ports. This population is in need of development of home products from the interior, many of the necessities of life are at present imported into the country.

A remarkable thing about the climatic conditions of this coast country is that it has not experienced rainfall in 22 years and for 700 miles south of Guyaquil, there is nothing but a sand waste with not even as much as a sign of cactus or sage brush. This country, however, has a substitute for rain in the nature of a heavy fog which settles on the coast for four months of the year. In Lima it is said to rain once in seven years. In eastern Peru, that is east of the First Cordillera, where is located the hydroelectric activity above alluded to, the country experiences regular wet and dry seasons. The wet season commences in February of each year.

The population is chiefly Quechera, descendants of the beautiful Inca civilization destroyed by the famous Spanish conqueror Pizarro. The vicinity of Oroya abounds in ruins of Inca villages and burial grounds, in which many mummies are to be found to this day.

In the countries of South America further to the south entirely different conditions exist. The climate is different, the resources of the country more varied and the possibility of early development much more encouraging and indeed every phase of human life and activity so much more advanced that a separate and distinct world would almost have to be imagined in order to properly transfer one's self and his thoughts to meet the new engineering horizon brought to view.

Whether it be northern South America or southern South America, however, ample opportunities present themselves for the young and aspiring. In each instance, development must come nevertheless from steady well directed activity rather than an attempt to capture by storm. For as a matter of fact there is nothing to capture by storm. The necessity for development must first be seen, then the capital for the building of the enterprise interested. As in the growth of our great West, this will come and will indeed take place by leaps and bounds, but the experiences gained from our own development teach us that quiet self-control in exploitation is far better than the blast of trumpet.

# PERSONALS

**F. N. Boyer,** manager of the St. Louis office General Electric Company, is a recent arrival at San Francisco.

**P. D. Calahan,** representing the Faries Manufacturing Company, Decatur, Ill., was recently at San Francisco.

**N. S. Braden,** sales manager of the Canadian Westinghouse Company, Ltd., Hamilton, Ontario, is at San Francisco.

**Thos. Mirk,** of Hunt, Mirk & Co., San Francisco, left the latter part of the week for an extended business trip East.

**William Clayton,** vice-president and managing director of the San Diego Electric Railway Company is at San Francisco.

**Harry U. Hart,** chief engineer of the Canadian Westinghouse Company, Ltd., Hamilton, Ontario, is a visitor at San Francisco.

**A. G. Wishon,** manager of the San Joaquin Light & Power Company, Fresno, Cal., was a visitor at San Francisco during the week.

**H. E. Sherman, Jr.,** representative of H. B. Squires Co., Los Angeles, spent several days during the week at San Francisco.

**R. R. Rand,** vice-president, treasurer and general manager of the Gas & Electric Company of Minneapolis, Minn., is at San Francisco.

**E. J. Dewald** is now at Salt Lake City where he has opened offices as district manager for the Platt Iron Works, in Utah, Idaho and Montana.

**E. G. Shore,** in charge of the Porterville office of the Mt. Whitney Light & Power Company, spent a few days at San Francisco during the week.

**John J. O'Connell,** engineer with the Electric Bond & Share Company, at New York, has returned home after a two months' trip through the West.

**E. A. Fricke,** electrical engineer of the Northern California Power Company, has returned to Redding after spending a few days at San Francisco.

**W. P. Sidley,** vice-president and general manager of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., is a visitor at San Francisco.

**Geo. R. Thomson,** representing R. J. Davis, district sales agent for the Century single-phase motors and fans, is visiting towns in the San Joaquin Valley.

**Ariya Chiokuty,** professor Imperial University of Tokyo, Japan, is a recent visitor at San Francisco, studying hydroelectric conditions on the Pacific Coast.

**A. M. Irwin,** assistant treasurer of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has returned to San Francisco from Los Angeles.

**Paul A. Shilton** of Los Angeles, representing R. J. Davis, district sales agent for the Century single-phase motors and fans, is making his annual trip through Arizona.

**H. V. Carter,** president of the Pacific States Electric Company, San Francisco, left during the week for a business trip to Portland, Seattle and the Northwest territory.

**Josiah Belden** of the General Electric Construction Company at San Francisco is the proud father of twins and is consequently receiving the congratulations of his friends.

**N. S. Hopkins,** purchasing agent of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., was a recent visitor at San Francisco, leaving for home via Portland and Seattle.

**Henry Herrmann,** manager of the metals department of the Fort Wayne Electric Works, accompanied by Mrs. Herrmann, spent a week in Los Angeles, en route to San Francisco.

**C. E. Condit** of the Northwestern Electric Company, addressed the Corvallis Branch of the A. I. E. E. at Corvallis, April 20th. on the "Transmission System of the Northwestern Electric Company."

**C. R. Wallis,** transformer and meter specialist, with the General Electric Company at Portland, has returned to that city after spending three weeks in Seattle and vicinity in the interests of his company.

**Kinji Uchimura,** manager of the Osaka Electric Lamp Company, Hiogo, Japan, recently spent several days at San Francisco enroute East where he expects to visit the large electrical industrial plants of this vicinity.

**E. M. Herr,** president of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., who has been spending some time at San Francisco, left during the past week for Portland, Seattle and the Northwest territory.

**Clark Baker,** Pacific Coast representative National Lamp Works of General Electric Company, finished a profitable trip to Southern California last week and is now starting his work in the Pacific Northwest at Portland.

**Yusake Anzo,** electrical engineer of the Inawashiro Hydroelectric Power Company, was a recent visitor at San Francisco enroute to the Westinghouse Works at East Pittsburg, which company has recently supplied the Japanese power company with a number of high capacity transformers.

**K. Kiminse,** electrical engineer, director of the Osaka Electric Lamp Company, and electrical adviser of the Osaka Electric Light Company, Hioga, Kea, Japan, spent several days at San Francisco enroute East, where he expects to spend considerable time looking into the electrical industry of this country.

**J. M. Eilbeck,** for sometime a right of way agent with Sanderson & Porter, engaged on construction of the Valley Pipe Line between Coalinga and Martinez, has joined the fuel oil sales department of the Shell Company of California. In this capacity Mr. Eilbeck will be in a position to be of great service to his many friends gained by his long residence in the British Northwest Territory and Alaska.

**J. W. Swaren** of the Pelton Water Wheel Company, is giving a lantern slide lecture before the students of various engineering and industrial schools on the Pacific Coast. This lecture covers every phase of an hydraulic development, from water resources to utilization of the power, showing the most recent types of practice. In addition there are a number of slides showing notes of historical interest in the development of hydraulic equipment.

**James F. Rogan,** Southern California representative of Edison Storage Battery Supply Company, while chairman of a recent meeting of the Los Angeles Ad Club, hoodwinked the members by producing two phonograph records purporting to reproduce brief talks by Theodore Roosevelt and Thomas Edison. It was only when **A. E. Morphy,** assistant secretary of the Southern California Edison Company, gave an imitation of the record alleged to have been made by Edison that the ad men realized the joke was on them.

**Dr. E. B. Rosa,** chief physicist of the U. S. Bureau of Standards, accompanied by **W. J. Canada,** are holding a series of hearings at Pacific Coast cities concerning a national code of safety in electrical construction and operation. During the past week conferences with the electrical interests of Southern California have been held at Los Angeles. Beginning May 3rd, at 10 A. M., similar meetings will be held in the Native Sons' building, San Francisco, and commencing May 8th, at Portland. These hearings are being held in conjunction with the public service commissions.

## MEETING NOTICES.

### Los Angeles Section of the A. I. E. E.

At the monthly meeting of the Los Angeles Section of the A. I. E. E., held on April 20th, at the Chamber of Commerce lecture hall, a paper was read by J. A. Bell on "The Application of Electricity to Grade Crossing Devices." A lively discussion followed the reading of the paper.

### California Association of Electrical Inspectors.

The monthly meeting of the association will be held at 2:30 p. m., May 8th, in the House Electrical, Manufacturers' Palace, P. P. I. E. At the last meeting Mr. Arthur Kempston of the Department of Electricity, was elected president; W. A. Brother, city electrician at Berkeley, vice-president; G. A. Cleary, electrical inspector with the Board of Fire Underwriters, secretary, and W. A. Spencer of San Jose and Frank Ellis of Oakland members of the executive committee.

### Alameda County Electrical Development League.

The monthly luncheon on April 24th was Jovian day, Tribune F. H. Woodward presiding and over sixty members attending. After an enjoyable musical program by Miss Steick, Mr. Woodward called upon a number of Jovians present as to their thoughts on the value of membership in the Jovian Order, the speakers including J. A. Vandegraft, A. H. Halloran, R. E. Fisher, H. A. Sayles, R. M. Alvord, W. C. Wurfel, E. A. Wilcox and Geo. Drew. Remarks were also made by Geo. King and Mr. Furness. As a membership committee for the next rejuvenation, Tribune Woodward appointed Messrs. Gribble, Drew, Myers and Hill.

### Electrical Development and Jovian League.

At the weekly meeting on April 28, T. E. Collins, first Jovian tribune, presided as chairman of the day. An unusual musical treat in the way of several violin solos was given by Jas. von der Meer. The principal speaker was Harris Weinstock, commissioner of the Industrial Accident Board of California, who gave a most interesting talk regarding "Industrial Relations." After tracing the growth of labor organizations he told of means that are now being taken about more harmonious relations between capital and labor. Each side now seems more open to reason and as a remedy he proposes the formation of a national board of arbitration to which all disputes may be referred. Hereafter, as a means of stimulating interest it is proposed that a free lunch be provided for five members holding the lucky number in a drawing to be conducted at each meeting.

### Portland Jovian League.

On April 16th W. H. P. Hill was chairman of the day and Dr. Edmund Myers spoke on "The Varied Uses of Electricity in Medicine." Mr. Warner made a report on behalf of the Electrical Parade Committee, in which he read the following resolution passed by the Rose Festival Association: Resolved, That the resolutions presented by the Portland Jovian League be received and that the Rose Festival Board agree to furnish the necessary floats, music, attendants, operatives and electricity, and that the offer of the Portland Jovian League to co-operate with the Rose Festival Committee on Electrical Parade be accepted, with the proviso that the Jovians participate actively as an organization and that they undertake to provide at their own expense any special features, electrical or otherwise, that they might add to the parade, subject to the approval of the Chairman of the Rose Festival Committee.

Mr. Warner said in addition that the committee had agreed to take the National Theater for six performance on May 14th and 15th; also that there was to be printed 9000 tickets for these performances and that it was up to the Jovians to sell some. Price of tickets, 25 cents apiece. The actual expense of running the National Theater would only be charged for same. A committee was duly appointed by the chairman of the day.

### Jovian Electrical League of Southern California.

The weekly luncheon of the league, held at Christopher's, Los Angeles, on April 21, was attended by 130 Jovians and their friends. It was ably presided over by Chester F. Fisher, who had provided a most entertaining program. Tribune Pieper announced that quite a number of Los Angeles Jovians will attend the San Diego rejuvenation on April 28th. He also aroused considerable sympathy and amusement by his statement that some one representing himself as Tribune Flenner of Boise City, had recently "done" him out of $5.00, and by reading Mr. Flenner's letter warning all Jovians of this imposter. Without implying any connection between the two incidents, Tribune Pieper then, most vigorously, imposed several heavy fines on those who appeared without badges. An N. E. L. A. convention committee was appointed, consisting of Messrs. Van Kuran, Morphy, Clapp, Spring, Murray, Case, Woodill, Benz, MacLean, Pomeroy, Pieper, Day, Northmore, Graham and Hall. A few reminiscent remarks were made by Professor Montraville M. Wood, an inventor and former associate of Mr. Edison, who is now lecturing on the gyroscope and ultra-violet rays. Mr. Ballard briefly outlined the plans for the entertainment of the N. E. L. A. visitors in June, including a visit to the Big Creek power plant. It was concluded to invite ladies to the luncheon on May 5th, when the new quarters of the league will be opened. Musical selections were rendered by Miss Addie Carlson, soprano; Harry Judson, baritone, and Ed. Schroder, pianist. Judge Robert L. Hubbard, a well-known single tax advocate, then gave "A Word on Taxation." He stated that little progress has been made in the world in solving the problem of taxation. While homes and merchandise represent human industry, land does not, and its possession should be considered a great privilege. We have a right to only so much of it as we can cultivate and is necessary for self-sustenance. He attacked the principle of taxing homes and business buildings more heavily than empty lots, as the former are of distinct advantage to a community, while the latter are held for purely speculative purposes. What we need is the "use" of land. Presence of civilization creates values, and occupancy of land will result from the taxation of tin-can lots the same as factory buildings. The judge declared himself squarely against all business taxation, and expressed the belief that if all property in Los Angeles were equally taxed, the income would be sufficent to sustain the city government without any other taxation.

### California Association of Electrical Contractors.

The regular monthly meeting of District No. 1, California Association of Electrical Contractors and Dealers and the jobbers, was held at the Forum Cafe, in Oakland, Friday, April 16. W. Gribble of the Kimball Electric Co. and president of the Alameda Section of the C. S. A. of E. C. & D., acted as chairman. Sixty-four contractors and jobbers sat down to dinner at 6 p. m. After the black coffee was served Mr. Gribble called the meeting to order and impressed on the members the necessity of getting action on the co-operative policies advocated and being sincere in carrying out the work. George King, secretary of the Alameda Section of the C. S. A. of E. C. & D., was introduced and read a paper on the difference between the old system of contractors' associations and the present. Wm. Berry was the next speaker and his subject was, "What are the Jobbers in San Francisco doing toward co-operating with the Contractors?" Mr. Berry, sales manager of the Western Electric Company, told how they were helping the contractors to organize, open retail stores, prepare more careful estimates, understand their costs and make better business men of themselves, also that much had been done to get the central station to stop the sale of appliances and lamps at a price less than the contractor could afford.

Mr. Gilson of the Gilson Electric Company of Oakland was asked the same question as Mr. Berry in reference to the Oakland contractors and jobbers. While Mr. Gilson covered much of the same ground that Mr. Berry did, still it was gratifying to hear him say that great progress had been made in Oakland, since the jobbers and contractors had started to co-operate. Mr. Gilson said the Oakland Association has grown from six members to about thirty-six at the present time.

Hugh Kimball of the Kimball Electric Company asked the jobbers what they should do to make the retail business pay, and subdivided his questions as follows:

1. Should the contractor be given a price protective to the consumer?

2. What should be the credit attitude of the jobber to the irresponsible contractor?

3. Should the jobber earnestly support the contractors' association?

Mr. Kimball illustrated his questions by comparing his own business with other businesses, such as grocery and hardware. Mr. Kimball was answered by C. C. Hillis, manager of the Electric Appliance Company. Mr. Hillis complained that he was at a disadvantage on account of the fact that he did not have an opportunity to prepare a talk as he did not know what Mr. Kimball was going to say. Nevertheless, he did very well and his answer to Question No. 1 was that he did believe the contractors were entitled to a protection on price to the consumers. To No. 2 that the jobbers were giving a great deal of attention to the credit attitude toward the irresponsible contractor, and that the work done by the jobbers present for the last eighteen months showed that they believed in earnestly supporting the State Electrical Association.

R. D. Holabird was the next speaker and spoke on retail business from a jobbers' standpoint. Mr. Holabird's experience has been such that he will be a valuable mind for the dealers, as he has had an experience that has allowed him to be placed on the same footing as the dealer, so he knows what the dealer is up against. The conclusions that could be drawn from Mr. Holabird's remarks are that it is essential that we must get more money for the goods we sell if we want to make money.

C. F. Butte, president of the San Francisco Section of the C. S. A. of E. C. & D., answered the question: Can an electrical contractor take large contracts on the basis of 10 per cent gross profit and make it pay? Mr. Butte's answer was No—and he illustrated same by going into detail and demonstrating the cost of taking care of an $8000 job, covering a period of two years.

Mr. W. L. Goodwin, sales manager of the Pacific States Electric Company, was asked the question: Am I satisfied with the progress being made by the co-operative movement between contractors and jobbers? The president of the state association drove home Mr. Butte's argument by relating some personal experiences. Mr. Goodwin's answer was Yes and No. Yes, because we were progressing nicely on the preparatory work necessary to accomplish results. No, on account of the fact that it took so long for some people to wake up and realize that unless they got with the association and attended the meetings, there was no chance for them to keep abreast of the times and make money. State Secretary W. S. Hanbridge was called on and requested the members to support the movement by attending the meetings, taking part in the deliberation and supporting the officers. Also he complimented the officers and members of the Alameda section for the work they had been doing and the fine showing made at this meeting. H. C. Reed of the Pacific Fire Extinguisher Company, complimented the Alameda section on the showing made by them during the last few weeks.

Chas. Wiggin, Dunham, Carrigan & Hayden, spoke of the necessity of the members attending meetings and working together. J. R. Boynton closed the program by calling attention to the work that was being carried out and of the credit that was due the jobbers for the assistance given in making the association a success. Adjournment was then taken to meet again in San Francisco at the regular quarterly meeting in May.

## NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has issued an order provisionally authorizing the City Electric Company to issue $426,000 face value of its first mortgage five per cent thirty-year sinking fund gold bonds. The order provides that the company may issue $250,000 of these bonds at 84 and accrued interest at the present time.

The commission has issued a supplemental order granting the Fowler Gas Company of Fowler, Fresno county, an extension of time to and including December 31, 1915, within which to issue $15,000 of bonds, authorized by the commission on June 11, 1914.

The commission has issued an order authorizing the Pacific Gas & Electric Company to issue $367,000 of its general and refunding mortgage gold bonds to the Bankers' Trust Company of New York as trustee. These bonds are a portion of the $4,586,661 of bonds authorized by the commission on June 30, 1914.

The Pacific Gas & Electric Company has filed an application with the commission, requesting authority to make a common stock dividend to the holders of its common capital stock.

The Mt. Konocti Light & Power Company of Lakeport, Lake County, has filed an application with the commission, requesting authority to issue 250 shares of capital stock having a par value of $100 per share.

The Midland Counties Public Service Corporation has filed an application with the commission, requesting authority to renew promissory notes totaling $136,844.43.

The San Joaquin Light & Power Corporation has filed an application with the commission, requesting authority to renew promissory notes in the total sum of $317,260.

The Supreme Court of California has rendered a decision denying the application of L. Chriest, proprietor of the Newport Beach Electric Light & Power Company for a writ of review in the matter of a decision rendered by the commission in which the Pacific Light & Power Corporation was authorized to operate in the city of Newport Beach.

The commission has issued an order approving a supplemental indenture entered into between the City Electric Company and the Anglo-California Trust Company under date of April 15, 1915. This supplemental indenture, which secures the City Electric Company's first mortgage five per cent, thirty year sinking fund gold bonds, includes, among other things, the guarantee of bonds as to principal and interest by the Great Western Power Company.

The commission has issued a supplemental order, authorizing the Santa Barbara Gas & Electric Company to issue $10,000 of its first mortgage six per cent, thirty year gold bonds. These bonds are a portion of the $100,000 of bonds which the Santa Barbara Gas & Electric Company was previously authorized to issue on February 27, 1915.

## NEWS OF IDAHO PUBLIC SERVICE COMMISSION.

The commission has denied the application of the Rupert Electric Company for relief from certain provisions of the general order for overhead construction.

The Utah Power & Light Company has been granted certificates of convenience and necessity to serve the towns of Ucon, Bonneville County; Menan, Jefferson County, and Parker, Fremont County, Idaho.

The commission has ordered the Idaho-Oregon Light & Power Company, the Idaho Power & Light Company, the Great Shoshone & Twin Falls Water Power Company, the Idaho Railway, Light & Power Company, the Southern Idaho Water Power Company, and the Utah Power & Light Company, to appear before it April 23 and produce all of their books, records, letters, files, documents, correspondence and any other matter or thing which will in any manner throw any light whatever upon the proposed merger.

The commission has denied the application of the Pacific Telephone & Telegraph Company to substitute a one-minute initial period plan for the present three-minute period, under a schedule whose effect would be to increase many of the rates now in effect.

## NEWS OF ARIZONA CORPORATION COMMISSION.

As the commission has taken no action in the matter of the application of the Arizona Power Company to supply power to consumers near principal substations at an "initial charge" less than $2 per horsepower of connected load for installation up to 25 h.p. the rates as filed became effective April 18, 1914, pursuant to Sec. 15 of Chapter 90, Sessions Laws of 1912.

The Southside Gas & Electric Company has been ordered to file a complete detailed statement of its operating expenses for the period from the 1st day of January, 1915, to the 1st day of March, 1915; a complete and detailed statement of its gross income for the same period, and such kilowatt hour consumption and station output as may be necessary to show the station loss, for the same period, in order that a further audit of its accounts may be made.

The commission has decided that the Pacific Gas & Electric Company's rule that "no contract shall be executed for gas and electric service for less than a gross revenue of $2," is excessive and has ordered that it be amended so as to conform to the views of the commission that "in the case of a consumer who changes his residence within a period of less than one month and who receives service at both addresses, an addition to the minimum bill of the amount of 50 cents for gas service and 50 cents for electric service shall not be deemed excessive."

In the matter of the Commonwealth Mining & Milling Company for permission to furnish water and electric power to its employes and other residents of the town of Pearce, the commission finds that it has jurisdiction over the public service departments of mining companies. Each case will be considered on its individual merits and in this case it decided that it had no occasion for disturbing existing rates or taking other action in the matter.

The commission has denied the application of the Pacific Gas & Electric Company for approval of minimum charge of one dollar per kilowatt of connected load per month to all lighting consumers whose connected load is in excess of five kilowatts. The company is using power purchased from the U. S. Government, and under no penalty respecting the maximum demand. Nor are at this time any consumers connected with the plant of the Pacific Gas & Electric Company for the purpose of taking stand-by service only.

The commission has ordered the Pacific Gas & Electric Company to extend its gas and electric service, and to serve houses now constructed, and to be constructed, in Oakland Addition, Phoenix. "The commission is of the opinion, from the record, that it is not unreasonable to require the respondent to extend its service into this Addition. A public service corporation occupying an exclusive field, such as presents itself in this instance, should hold itself in readiness ot make reasonable extensions to serve new districts. The commission is of the opinion that a company is entitled to protection against occupancy of an exclusive field when a disposition is shown to comply with the foregoing principle."

The Arizona Power Company has been authorized to issue 70 of its first mortgage bonds of a total face value of $70,000 for the purpose of reimbursing its treasury for money heretofore expended in extensions to lines, the acquisition and installation of equipment and improvements to its plant and system and office equipment. It has also been authorized to dispose of $250,000 of its 3½ year eight per cent collateral gold notes, for the purpose of building a second power plant on Fossil Creek, having a capacity of 1750 h.p. These rates are to be secured by $400,000 in bonds deposited with the Guarantee Trust Company of New York.

## TRANSACTIONS OF INTERNATIONAL ENGINEERING CONGRESS.

Volume IV of the transactions of the Congress will comprise an important series of papers on the general subject of Railways and Railway Engineering. This field will be treated under seven principal topics covering relation of railways to social development; present status of railways; economic factors governing building of new lines; location; physical characteristics of road including track and roadbed; bridges; tunnels; terminals; construction methods; signals; road equipment including motive power other than electric; rolling stock in general; floating equipment; electric motive power in general.

Approximately 27 papers are expected for this volume, prepared by authors, representing 9 different countries. The list of authors includes many of the most eminent names in this field of engineering work throughout the world.

The volume as a whole will be illustrated with charts, diagrams and half tones, together with discussions contributed by leading American and foreign engineers, and will form a most valuable acquisition to the library of all engineers and others who may be interested in these phases of engineering work.

The transactions of the congress as a whole will include nine or ten other volumes, covering the various fields of engineering work.

## PUBLICATIONS RECEIVED.

"Public Utility Economics" is the subject of a series of ten lectures delivered before the Finance Forum of the West Side Young Men's Christian Association of New York City, which have been published by the Utilities Publication Committee, 30 Church street, New York. The subjects and authors of the various lectures are as follows: "Magnitude of the Electric Light, Power and Transportation Business," by T. Commerford Martin; "The Public, the Investor and the Holding Company," by Francis T. Homes; "Municipal Ownership of Public Utilities," by Arthur Williams; "Progress of the Science of Lighting," by Dr. Edward P. Hyde; "Telephones at Home and Abroad," by T. P. Sylvan; "Future of Public Utilities," by Thomas N. McCarter; "Centralization of Power Supply," by Samuel Insull; "Investments in Public Utilities and How Held," by W. H. Gardiner; "Future Regulation of Public Utilities," by William D. Kerr; "Some Legal Aspects of Regulation of Public Service Commissions," by Charles F. Mathewson.

FLORENCE, ORE.—The city council has passed a resolution providing for the issuance and sale of $10,000 worth of bonds for furnishing the inhabitants of Florence with an adequate water supply. The resolution also provides for an election to be held June 7, at which time the proposition will be voted upon.

SAN DIEGO, CAL.—Electors of East San Diego will vote May 4th on a proposition to issue $70,000 bonds with which to acquire a municipal water system. It is proposed to purchase the present system comprising about forty miles of pipe, certain real estate, buildings, equipment, etc., for $41,000 and to also vote an additional $29,000 for improvements to be installed.

EPHRATA, WASH.—A deal has been consummated whereby F. P. Gover takes over the city water system, which has been operated by L. H. Pruitt, for $20,000. Mr. Gover states that it is his intention to develop the plant. He will increase the storage capacity three times the present amount, to improve the mains and make extensions.

## TRADE NOTES.

Smith, McCoy Electric Company has the electrical contract for the building, 275 Morrison street, Portland, Oregon.

The Light House has the electrical contract for the electrical equipment of the Weinhard Estate Building, 68 Fifth street, Portland.

Miller & Halls have the contract for the erection and wiring of five additional electric arches for Third street, Portland, Oregon.

M. J. Walsh & Co. have the electrical contract for a four story apartment house being constructed at Broadway and Davis streets, Portland, Oregon.

Ne Page, McKenny Company have the electrical contract for the new building being constructed by the Coin Machine Company, 984 Alice street, Portland, Oregon.

F. H. Bauman & Company have the electrical contract for the electrical installation in the apartment house being built by F. I. Dunbar and F. R. Davis in Astoria, Oregon.

The Seattle branch of the General Electric Company has closed a contract with the Walton Lumber Company of Everett for one 250 kw., belt driven generator and a number of motors.

The Seattle Board of Public Works has purchased a pump and motor from the Power Plant Equipment Company at approximately $2599 and pump and motor for the Interbay Station from Fairbanks, Morse at approximately $2070.

The Westinghouse Electric & Manufacturing Company announce that they have closed a contract, through their Butte, Mont., office with the Anaconda Copper Mining Company, Anaconda, Mont., for two 45-ton, 600-volt, d.c. electric locomotives equipped with standard H-L control and the latest types of motors.

The Benjamin Electric Manufacturing Company, F. H. Poss, Pacific Coast manager, owing to increasing business and the enlargement of their line, have found it necessary to take larger quarters and to combine their warerooms and offices. They now occupy the entire first floor and basement at 590 Howard street.

The Crescent Electric Company of Portland has the contract to install the following 440 volt 3-phase, 60 cycle induction motors in the Emerson Hardwood Company, Portland, Oregon; 1-75 h.p., 4 40 h.p. 1-50 h.p.. A 300 volt bus is to be run to each motor and oil switches used for starting instead of auto starters.

Among the orders received in the Seattle office of the General Electric Company recently is one from the Wilkinson Coal & Coke Company at Wilkinson, Wash., for a 600 r. p. m. 2200-volt, 3-phase motor attachment, with control apparatus, for use with a hoist being built by the Pacific Iron & Steel Company at Tacoma, Wash., together with a considerable amount of cable.

The Bureau of Standards, Department of Commerce, will hold a conference in Portland, Oregon, May 8 to 10, 1915, on the Proposed National Electrical Safety Code. Mr. C. B. Aitchinson, railroad commissioner of Oregon, has been asked to arrange for the conference and also Mr. Hoff of the Bureau of Labor, Mr. O. B. Coldwell of the Portland Railway, Light & Power Company, and Mr. F. D. Weber of Underwriters' Eg. Rating Bureau have been asked to assist.

A patent on electric railway systems has just been allowed Mr. Otto E. Falch, Jr., of San Francisco. This invention makes it practical to use a.c. on railway systems similar to the third rail type, and will be of interest to many electric railway engineers. The prohibitive drop due to the self induction in the steel third rail when using a.c. is overcome, and it not only has its advantages in supplying current to the cars or trains of rapid transit systems and electric railways in general, but also in connection with signal systems for same.

C. M. Thompson, Pennsylvania representative of the Kellogg Switchboard & Supply Company, planned an especially interesting exhibit for the meeting of the Pennsylvania Telephone Association held at Harrisburg, Pennsylvania, in the Cumberland Valley Telephone Company building. The big three-position instantaneous recall switchboard, a magneto switchboard and the Kellogg Universal switchboard, demonstrating equipment in private branch exchange form were on display. Also the Kellogg apparatus display panels, including magneto and common battery telephone equipment. In order to be assured that every Pennsylvania telephone man who planned attending the meeting would know that a comprehensive and valuable exhibit was being arranged for his convenience and pleasure, Mr. Thompson had issued a letter, enclosing an illustration of one of the well-known Kellogg instantaneous recall board exchanges—photograph taken before and after the installation of this efficient equipment. This circular and letter was followed up with postal cards in two colors as further reminders. Kellogg men in attendance were: Mr. C. M. Thompson, representative in charge of the exhibit; Mr. J. B. Edwards, general manager and vice-president of the Kellogg Company; Mr. A. J. Carter, general sales manager, and C. D. Boyd, sales engineer, and M. B. Stazek, engineer. As it was a joint gathering of the Eastern Pennsylvania and Western Pennsylvania Telephone Associations, there was an unusually large attendance.

## NEW CATALOGUES.

Bulletin No. 201-1 from the Standard Underground Cable Company gives the specifications under which their Colonial Copper Clad wire is manufactured. "33 Years of Progress" is a story of this company's exhibit at the Panama-Pacific International Exposition.

Bulletin No. 52 from the Byron Jackson Iron Works of San Francisco contains useful engineering data pertaining to pumping problems on pages alternating with illustrations and descriptions of various types of centrifugal pumps.

Bulletin No. 12 from Benjamin Electric & Manufacturing Company supplements previous catalogues and bulletins pending issue of their new catalogue B-21. Several new reflectors are listed, including a complete line of shade-holder type in both enameled and aluminized steel. A number of new lighting specialties are also illustrated and described for the first time.

The General Electric Company has just issued Bulletin No. 43,900, describing that Company's Combined Unit Series Mercury Arc Rectifier Outfits. This outfit is designed to convert alternating current into direct current for the operation of Series Luminous Arc Lamps. These sets are made in 25, 50 and 75 light sizes, for 25 and 60 cycles, 2200 volt primary, and 4, 5 and 6.6 amp, secondaries. The construction of the outfit is illustrated and described in considerable detail. The bulletin contains dimension and connection diagrams, together with catalogue numbers and other data.

## TELEPHONE PIONEERS' CONVENTION.

The fifth annual convention of the Telephone Pioneers of America will be held in San Francisco Tuesday, Wednesday and Thursday, September 21, 22 and 23, during the Panama-Pacific Exposition. This was decided at a recent meeting of the executive committee, and the following were appointed a committee of arrangements with authority to appoint the necessary sub-committees: George E. McFarland, president, Pacific Telephone & Telegraph Company, San Francisco; A. S. Hibbard, American Telephone & Telegraph Company, Chicago; and Gerard Swope, vice-president and general sales manager Western Electric Company, New York City.

# INDUSTRIAL

## DIRECT CONNECTED EXCITERS.

A single great reservoir of power, to be drawn upon as required, was once believed by power designers to be the ultimate development of the central station. Carrying out this idea, all of the generators were to be connected to one bus-bar and would be excited from a central direct current system. However, as central stations were built in increasing capacities, the necessity for subdivision on account of excessive short circuit currents became manifest.

The present tendency is to lay out the station as a number of independent units, so that trouble on part of the system will not cause a shut down of feeders and apparatus other than those directly affected. Especially is this trend noticeable in the case of hydroelectric plants where the power is used over a wide territory and must be delivered

Westinghouse Direct Connected Exciter.

over long transmission lines which are particularly liable to trouble. To render each generator unit independent, many engineers now favor the use of individual exciters, each connected to its own generator.

The Westinghouse Electric & Manufacturing Company has perfected a line of exciters especially adapted for such service. The chief point urged against direct connection is that trouble in the exciter necessitates shutting down the generating unit unless leads are provided for exciting the generator from some other exciter unit. Hence reliability is the primary requirement in exciters designed for direct connection. Westinghouse designers have fully recognized this fact, and these exciters are characterized by rugged mechanical details and great overload capacity.

While these exciters are generally built especially for the particular generator to which they are to be attached, in the details of their design and construction they are similar to the standard Westinghouse engine and belt-driven direct current generators.

Several methods of mounting the exciter are employed. In the case of a vertical generator the exciter is carried by the thrust bearing bracket. With a horizontal generator, the exciter frame may be mounted on an extension of the generator bed plate, on a bracket attached to the bearing pedestal, or on a separate base.

The use of the direct connected exciter has the following advantages: Each generator is dependent upon only its individual exciter, the number of plant auxiliaries is reduced, rheostat losses tend to be less, belts and belting troubles are eliminated, and a neat and compact appearance is secured.

The cost of the direct connected exciter varies somewhat with the type of main generator with which it is to be used. This is due to the varying amount of excitation required by the alternator, which depends materially on its operating speed. A slow speed unit will require more excitation than a higher speed machine of otherwise similar characteristics, and the slower the exciter runs, the more expensive it will be. For this reason, direct connected exciters for engine driven sets or slow speed water wheels make a more expensive layout than where the higher speed water wheel, belted, or turbo driven generator is employed.

In addition to the advantages of greater freedom from trouble, etc., it is frequently true that an outfit of direct connected exciters will be cheaper than any other arrangement. This is particularly the case in hydroelectric plants where other arrangements, affording equal independence, entail a much greater first cost.

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## AN INTERESTING MEXICAN HYDROELECTRIC INSTALLATION.

The power house of the San Luis Mining Co. in Sinaloa, Mexico, is of unusual interest. The Piaxela River, in its course from the interior highlands to the sea, flows for many miles through barren, rainless foothills before reaching the moist belt of coast land. Somewhat more than one hundred miles northwest of Mazatlan it makes a wide ox-bow curve, flowing for several miles between walls of solid rock, to return at one point within a few yards of its earlier course. At this point the power house is built. A tunnel a little more than two hundred feet long, driven through solid rock, pierces through to the upper course.

In the power house are two Pelton-Francis turbines. The original power house is of sun-dried adobe construction, but a new addition in which a third Pelton-Francis turbine is now being installed is excavated out of solid rock.

All of the machinery was sectionalized for mule-back transportation and the greater portion of it was thus brought in. Some of the more special pieces and some that were too large for mule-back transportation were packed in by Indian carriers—a long pole resting on the shoulders of the Indians being used, with the piece in question suspended from the middle.

The outcrop on which the San Luis Mining Company's workings are developed is associated in tradition with the source of gold exploited by the Montezumas before Cortez started Mexico on its career of adding a touch of melodrama to civilization.

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OREGON CITY, ORE.—Oregon City's pure water commission has signed a double contract with the the Oregon Engineering & Construction Company for the construction of the South Fork pipe line. The two contracts cover the grading work and the actual construction of the pipe itself. The money consideration involved in the contract is between $280,000 and $290,000. The Oregon Engineering & Construction Company will sublet the furnishing of the pipe and possibly other sections of the work, but will be responsible for carrying out of the water commission's plans.

# NEWS NOTES

## INCORPORATIONS.

EVERETT, WASH.—Articles of incorporation have been filed for S. Fork Telephone Co., by Geo. L. Snodley, James Bartlett and H. L. Hanson. Capital stock, $750.

ABERDEEN, WASH.—The Aberdeen-Hoquim Gas & Power Company has been incorporated for $350,000 by L. H. Burnett, Samuel Benn, F. A. Archer, and W. W. Boner.

## ILLUMINATION.

DEER LODGE, MONT.—Contract for installation of cluster light system awarded to J. W. & C. W. Currah, Helena, Mont., for $4300.

TEKOA, WASH.—The Washington Water Power Company has started work on completely rebuilding the lighting system of the town.

ELLENESBURG, WASH.—An election will be held May 11 to vote on the question of $60,000 bonds for the new municipal lighting plant.

BATTLE MOUNTAIN, NEV.—The Lander County Electric Light, Power & Water Company has purchased a site west of town and will erect a power house.

ARLINGTON, ORE.—The city council has passed an ordinance providing for the installation of meters within sixty days on all places using current from the city's power plant.

HOQUIAM, WASH.—L. H. Burnett, president of the Aberdeen & Hoquiam Gas Corporation, announced that work would be under way in about 60 days on the construction of a gas plant in Aberdeen.

SEATTLE, WASH.—The port commission has awarded a contract to the Rainier Electric Company, 208 Columbia street at $3543, for the installation of a light and power system for the Fruit Storage Building.

McMINNVILLE, ORE.—John Moore, manager of the Yamhill Electric Company at Newberg, has placed a proposition before the water and light commission for furnishing electricity to McMinnville during the summer.

LOS ANGELES, CAL.—Bids will be received by the board of supervisors up to May 3d, for installing and maintaining an addition to the system of street lighting in the Palms Lighting District, and for furnishing electricity for additional lights.

TUCSON, ARIZ.—The people of Casa Grande have voted to grant E. R. Brackett a franchise to operate an electric light and power plant in that town. The complete installation of the plant, including poles and wires, will cost about $150,000.

TEHACHAPI, CAL.—At a recent election bonds in the sum of $8000 were voted for a light plant. The town will get current from the Pacific Light & Power Company. The system is being installed for about $11,800, of which Tehachapi is to pay $8000.

PASADENA, CAL.—The city commission has resolved to order the construction and the installation of posts, conduits, wires, lamps and other suitable appliances in and along El Melino avenue, Alpine street and Pinehurst Drive for the purpose of lighting the same.

HERMOSA BEACH, CAL.—The board of trustees has passed a resolution that ornamental lighting posts with appliances be installed on Manhattan Court, Hawthorne, Tennyson, Ruskin, Browning, Milton, Longfellow, Burns, Byron, Homer, Manhattan and Hermosa avenues, Palm Drive, First street and Strand.

SAN JOSE, CAL.—Electroliers of 5 lamps each, connecting the present system which ends at Orchard street, with the Alameda system of lighting and an ornamental electric arch across the Delmas avenue bridge, are two important improvements put under way by the West Santa Clara Improvement Association.

SEATTLE, WASH.—Superintendent of Lighting Ross has recommended the construction of an addition to the Lake Union municipal steam plant to double its capacity and increase its power load to 20,000 kilowatts. Sealed proposals will be received by the board of public works until May 7th for furnishing and installing boiler, superheater, piping, etc.

## TRANSMISSION.

MONTESANO, WASH.—A franchise has been granted to the Northwest Electric & Water Works, to construct and operate an electric line along the public highways.

OKANOGAN, WASH.—The Okanogan Valley Power Company has been granted a franchise by the board of commissioners for extension of their power line from Omak to Riverside.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has applied to the county commissioners for a 50 year franchise on the county roads to its distributing lines in Moxee Valley.

PORT TOWNSEND, WASH.—Jas. P. Holman has made application to the board of county commissioners for the right to construct power lines for conveying electricity in Jefferson county.

MONTESANO, WASH.—The county commissioners have granted a permit to P. R. Smith for the construction of an electric light line along the streets in Ocean View addition to Moclips, Wash.

MOSSY ROCK, WASH.—It is reported that W. E. Arnold, local representative of the D. H. J. Oil Company of Seattle, has secured options on land one mile north of town to be used as a power site.

ENUMCLAW, WASH.—The Enumclaw Water & Light Company has been granted a franchise to construct a pole line along the streets of this city for the transmission of electricity for power, heat and light.

ST. ANTHONY, IDAHO.—A franchise has been granted by the council to the Utah Power & Light Company to construct and maintain a power dam and spillway across the north fork of the Snake River at or near the upper east end of the island.

VANCOUVER, B. C.—The fire and police committee is requested to investigate the question of water power sites which may be of utility to the city, having in view their acquisition for the purpose of constructing power plants to supply the city with light and power.

EVERETT, WASH.—Scott Calhoun, representative of the Washington Power Company, which has holdings in the Sultan Basin, proposes that this city acquire the holdings of his company at the same time it builds a municipal water system. Consideration is being given to the plan.

EL PASO, TEX.—At a joint meeting of the officers of the Mesilla Valley Water Users' and the Elephant Butte Water Users' Associations plans were discussed for the erection at the Elephant Butte dam of power plants for generating electricity, to be used in Mesilla and Rio Grande valleys. It is estimated that the cost will be from $1,000,000 to $2,000,000.

RENO, NEV.—While State Engineer Kearny was busy last week in Owyhee, Lamoille, South Fork and Salmon River valleys, his assistants, Seymour Case and Cash Smith were also busy at Lovelock and Smith at Clover Valley investigating water rights. Kearny says that the preliminary work of adjudicating water rights under the new 1915 water law has already been begun and will be carried on as ex-

peditiously as possible. Elko county is to have a new power project, according to present plans. Leon M. Hall of Virginia City and San Francisco, has completed plans for a power plant of 1500 horsepower with a maximum possibility of 4000 horsepower to be installed on the South Fork of the Humboldt River. The power is intended for the mining camp of Bullion it is understood. Permission to take water from the South Fork for power purposes has been granted with the provision that it be returned to the stream above the farm lands. One of the purposes of Mr. Kearny's trip into Elko county from which he returned was to gather data on the Salmon River Carey Act project of the Twin Falls-Salmon River Land & Water Co. It is alleged that the company is appropriating the water of an interstate stream. The state of Idaho has filed a suit against the Utah Construction Company, owners of the old Sparks Herald ranch and the state of Nevada expects to file a suit in intervention. The stream carries an annual flow of 150,000 acre feet. To investigate the case State Engineer Kearny went to Rogerson, Idaho, seven miles north of the state line. A concrete dam has already been constructed by the Idaho company just over the line in Idaho.

## TRANSPORTATION.

ANACONDA, MONT.—It is stated that the Northern Pacific Railroad has begun an expenditure of more than $100,000 on the line between Garrison and Missoula in reconstruction of all electric signal apparatus.

LINNTON, ORE.—O. M. Clark, Richard Shepard and J. B. Holbrook have applied to the county commissioners for a franchise for an electric road to take place of one abandoned by the United Railways line. The estimated cost is $100,000.

FRESNO, CAL.—The city trustees have granted the Fresno Interurban Railway Company a franchise for a double track line from Belmont and Fresno avenues, along Belmont to Valeria, along Valeria to Merced, along Merced to J, along J to Inyo, along Inyo to L, and along L to the southeastern city limits.

## TELEPHONE AND TELEGRAPH.

MODESTO, CAL.—Permission has been granted F. D. Ford to erect a telephone line along certain streets of this city.

GLASGOW, MONT.—The Moore Telephone & Telegraph Company is making preparations to extend its lines 55 miles north from Glasgow to Glentana and Opheim.

DAVENPORT, WASH.—The Bachelor Prairie and Welch Creek Telephone Company, by Samuel Squires, president, has asked for a franchise. A hearing will be held May 4th.

WALLULA, WASH.—Burbank Water Users' Association have organized the Burbank Mutual Telephone Company to take over the Culp telephone line from Burbank County.

OLYMPIA, WASH.—The supreme court has ruled that a telephone company which allows a second company to connect with its line must allow the same privilege on the same terms to other companies.

DILLON, MONT.—The Mountain States Telephone & Telegraph Company has been granted a permit to change its lines in accordance with plans showing prospective changes and to place poles and wires accordingly.

## WATERWORKS.

CHELAN, WASH.—The Great Northern Railroad Company has decided to build a temporary power plant here this spring to pump water for irrigation.

DOUGLAS, ARIZ.—The contract for furnishing 25,000 ft. of 4 in. water main to the city water department has been awarded to Momsen-Dunnagan-Ryan Co. of El Paso for $9000.

BRAWLEY, CAL.—The contract to supply pipes and fittings for the first extension to the water system has been awarded to the Boynton Company of Los Angeles, for $1747.

ENUMCLAW, WASH.—The Enumclaw Water & Light Company has been granted a franchise to lay and operate water pipes for the distribution of water for municipal and domestic use.

RIVERSIDE, WASH.—Bids will be received by the town clerk, W. H. Patterson, until May 4th for the construction of a water system for this city, according to plans and specifications on file in the office of the clerk.

INDIO, CAL.—J. L. Marshall is erecting a new tower for the city pumping station to be followed by a 15,000 gallon wooden tank. Next will be installed a 6 in. main running east and west to connect with smaller mains running north and south.

PORTLAND, ORE.—Commissioner Daly of the department of public utilities, has ordered work started on the extension of the 30-inch reinforced main from East 59th and Fremont streets to the Vernon stand pipe. The construction of the main will cost about $120,000.

ABERDEEN, WASH.—Aberdeen will seek to secure water and power rights on the Wynooche and form a Wynooche Water District, with the ultimate end of building there a gravity water system for the use of this city. City Attorney A. E. Cross was instructed to go to Portland and confer with forestry men on securing rights for the city of Aberdeen in the Wynoochee watershed. The council wants both water and power rights.

SACRAMENTO, CAL.—The new water system will be supplied and laid by the Schaw-Batcher Company of this city, the city commissioners having accepted the alternate $593,528 proposal of the local firm. The city will pay pipe freight charges of $123,000, thus making the total cost of the new system $716,528. Although the action of the commissioners assures the local firm the job, the Schaw-Batcher Company must sell $805,457 worth of municipal bonds for the city before the actual contract is awarded.

MILWAUKEE, ORE.—The city council has decided to call a special election May 1st to decide whether the council shall be authorized to acquire the Milwaukee water works and the Minthorn Springs Company plants by arbitration or condemnation, and whether Bull Run water or Minthorn springs water shall be used for the municipal water works. It is considered certain that another bond issue will have to be made to pay for the two plants if they are bought and to complete the municipal water works. About $38,000 will be required.

OGDEN, UTAH.—That the pipe for the city water works extension through Ogden canyon, together with the laying of it, will cost approximately $90,000 was shown recently when bids for the material and the labor were received by the city commission. The total of lowest bids on the work, there being three separate divisions of the contract, is $89,-092. This includes Matheson joint pipe for the extension from Coldwater canyon to the Utah Light & Traction Company dam, wooden stave pipe from the dam to the wells, the necessary concrete reservoir at the wells for the assembling of the flows and the trenching for all of the extension. Only one bid was received for the delivery of Matheson joint steel pipe, 18,400 ft. to be used. This was from the George A. Lowe Company, the offer being $49,050. Eight bids were received for the delivery of the wood stave pipe and the laying of it in the trenches. The lowest bidder on California redwood was the Wheelwright Construction Company at a total of $18,572. For either Oregon fir or Douglas fir, the offer of the Washington Pipe & Foundry Company of Tacoma totalling $15,912, was the lowest received.

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B-2 **Benjamin Electric Manufacturing Co.**..... 5
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B-3 **Blake Signal and Manufacturing Co.**.....
680 Howard Street, San Francisco.

B-5 **Bridgeport Brass Co.**.....10
(See Pierson, Roeding & Co.)

B-6 **Berkeley Electric Cooker Co**.....
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B-7 **Busch-Sulzer Bros.-Diesel Engine Co.**.....
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C-1 **Century Electric Co.**.....14
614 South Grand Avenue, Los Angeles; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-3 **Crocker-Wheeler Co**.....
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C-4 **Cutler-Hammer Manufacturing Co.**..... 4
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D-1 **D. & W. Fuse Co.**.....14
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D-2 **Dearborn Drug and Chemical Works**.....11
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E-2 **Edison Storage Battery Supply Co.**..... 4
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E-3 **Electric Agencies Co.**.....
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F-1 **Fairbanks, Morse & Co.**..... 3
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F-2 **Fort Wayne Electric Works of G. E. Co.**.....
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G-1 **General Electric Co.**..... 12
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H-2 **Hemingray Glass Co.**.....10
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H-6 **Hubbard & Co.**.....
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I-1 **Indiana Rubber and Insulated Wire Co.**.....
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K-1 **Kellogg Switchboard and Supply Co.**.....
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N-4 **New York Insulated Wire Co.**..... 2
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S-5 **Sprague Electric Works**..... 3
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S-6 **Standard Underground Cable Co.**.....10
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T-1 **Thomas & Co., R.**..... 11
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W-1 **Wagner Electric Manufacturing Co.**.....10
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W-2 **Western Electric Co.**.....
8th and Santee Streets, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 907 First Avenue, Seattle; 45 North Fifth Street, Portland, Ore.

W-4 **Westinghouse Electric and Manufacturing Co.**.....
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Second and Cherry Streets, Seattle; Paulsen Bldg., Spokane.

W-5 **Westinghouse Machine Co.**.....
141 Second Street, San Francisco.

W-6 **Westinghouse Lamp Co.**.....
(See Westinghouse Electric and Manufacturing Co.)

W-8 **Western Pipe & Steel Co.**.....
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